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Ischua Creek

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization.

The examination of available engineering documents and visual inspection of the Ischua Creek Watershed Project-Site 6A dam did not disclose conditions which constitute a hazard to

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downstream human life or property.

The total discharge capacity of the combined principal and auxiliary spillways is adequate to impound and safely discharge the floodwater resulting from the Probable Maximum Flood (PMF).

A few minor deficiencies were noted on this structure. These deficiencies include debris (logs) along the riprap lined section of the upstream slope; a depression behind the south wall of the impact basin over the west principal spillway outlet pipe, a wet area near the contact between the berm and right abutment along the downstream slope of the dam between stations 8 + 00 and 9 + 00, leakage around the reservoir slide gate when fully closed, erosion of the downstream toe and rip rap west of the impact basin. These deficiencies should be corrected within 6 months of the date of notification to the Owner. A warning system and evacuation plan should be developed and implemented within 6 months for notification of downstream residents and the proper authorities.

ALLEGHENY RIVER BASIN

ISCHUA CREEK WATERSHED PROJECT
SITE 6A

CATTARAUGUS COUNTY, NEW YORK

INVENTORY NO. N.Y.571

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

(6) Ischua Creek Watershed Project Site 6A
(Inventory Number NY-571), Allegheny River Basin
Cattaraugus County
New York, Phase I
Inspection Report,

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
ISCHUA CREEK WATERSHED PROJECT
SITE 6A
I.D. NO. N.Y. 571
ALLEGHENY RIVER BASIN
CATTARAUGUS COUNTY, NEW YORK

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APPENDICES

Appendix A - Photographs

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

NAME OF DAM:	Ischua Creek Watershed Project Site 6A, Inventory No. N.Y. 571
STATE LOCATED:	New York
COUNTY:	Cattaraugus
RIVER BASIN:	Allegheny
WATERSHED:	Ischua Creek
STREAM:	Gates Creek
DATE OF INSPECTION:	May 5, 6 and 20, 1980 See Vicinity Map & Topographic Map, Appendix E

ASSESSMENT

The examination of available engineering documents and visual inspection of the Ischua Creek Watershed Project-Site 6A dam did not disclose conditions which constitute a hazard to downstream human life or property.

The total discharge capacity of the combined principal and auxiliary spillways is adequate to impound and safely discharge the floodwater resulting from the Probable Maximum Flood (PMF).

A few minor deficiencies were noted on this structure. These deficiencies include debris (logs) along the riprap lined section of the upstream slope; a depression behind the south wall of the impact basin over the west principal spillway outlet pipe, a wet area near the contact between the berm and right abutment along the downstream slope of the dam between stations 8 + 00 and 9 + 00, leakage around the reservoir slide gate when fully closed, erosion of the downstream toe and rip rap west of

the impact basin. These deficiencies should be corrected within 6 months of the date of notification to the Owner. A warning system and evacuation plan should be developed and implemented within 6 months for notification of downstream residents and the proper authorities.

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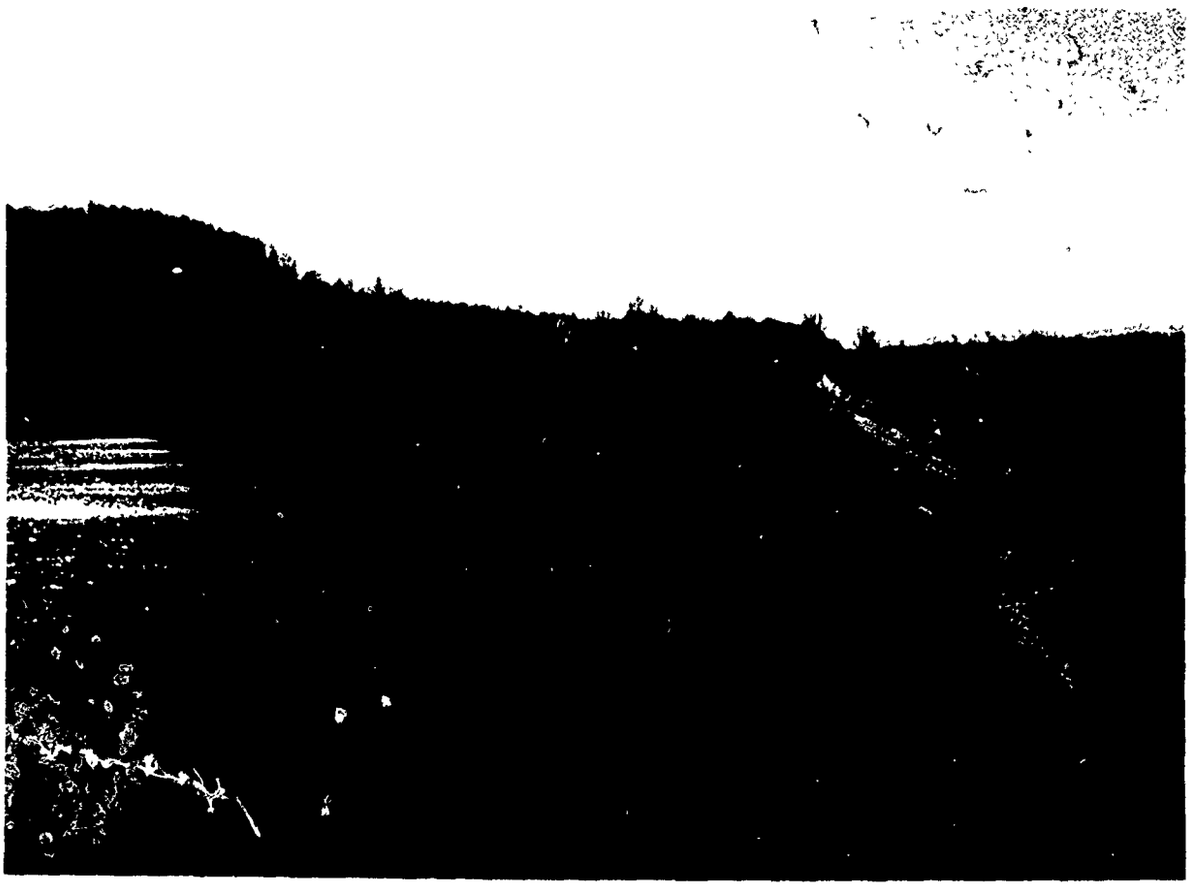
APPROVED BY 10 SEP 1980

New York District Engineer
Colonel W. M. Smith, Jr.



View of upstream embankment
slope from east spillway

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
ISCHUA CREEK WATERSHED PROJECT
SITE 6A
I. D. No. NY. 571
ALLECHENY RIVER BASIN
CATTARAUGUS COUNTY, NEW YORK

SECTION 1: PROJECT INFORMATION

1.1 GENERAL

a. Authority

This Phase I Inspection Report was authorized by the New York State Department of Environmental Conservation by Contract No. D-201458. This study was performed in accordance with the terms of the above contract and the Recommended Guidelines for Safety Inspection of Dams prepared by the Department of Army, Office of the Chief of Engineers to fulfill the requirements of the National Dam Inspection Act, Public Law 92-327.

b. Purpose of Inspection

This inspection was conducted to obtain available data concerning design and construction of the dam, to evaluate that data, to visually inspect existing conditions at the dam, to identify and evaluate deficiencies and/or hazardous conditions which, if present, may threaten life and property of the residents downstream of the dam and to recommend remedial measures to mitigate such deficiencies and hazardous conditions.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam

The Ischua Creek Watershed Project Site 6A consists of an earth dam with two principal spillway outlet pipes passing

through the embankment and auxiliary spillways passing around the east and west ends of the dam.

The dam embankment consists of compacted glacial till soils, having the maximum height of 63 feet, a crest width of 20 feet and a crest length of 1043 feet. The upstream slope is 1 vertical on 3 horizontal with a 15 foot wide berm at elevation 1650.0 and a downstream slope of 1 vertical on 2.5 horizontal with a 16 foot wide berm at elevation 1650.0. The upstream slope is lined with riprap 18 inches thick and 12 inches of bedding for the riprap between elevation 1656.0 and 1664.0. These elevations correspond to 5 feet below 3 feet above normal recreation pool elevation 1661.0. The remainder of the upstream slope above the recreation pool, the crest and the downstream slope are grass covered. An earth cutoff trench of varying depth and widths between 12 and 24 feet keys the embankment into the glacial till and bedrock foundation material.

The principal spillway consists of the following components; two (2) rectangular reinforced concrete drop inlet structures with a crest elevation of 1661.0, two (2) 42 inch I.D. reinforced concrete outlet pipes, two (2) reinforced concrete impact basins and a riprap lined outlet channel. The reservoir drain is a 30 inch I.D. reinforced concrete pipe extending 104 feet into the reservoir from the base of the east drop inlet structure. A manually operated vertical slide gate mechanism mounted on the top and inside of the east drop inlet structure controls the flow through the reservoir drain.

The auxiliary spillways are located in cut sections at the east and west ends of the dam. The east auxiliary spillway has a bottom width of 250 feet whereas the bottom width of the west auxiliary spillway is 200 feet.

The internal drainage system consists of 10 foot wide drain trenches cut into the foundation material. The trenches are filled with a "gravelly material". Seepage from the trenches is collected in two 10 inch diameter perforated bituminous coated corrugated metal pipes surrounded by "filter" material and extend parallel to the dam axis 100 feet downstream from the dam centerline.

The perforated sections terminate near the principal spillway outlet pipes where solid 10 inch diameter bituminous coated corrugated metal pipe bends 90° and outlets to the outlet channel on either side of the impact basins.

b. Location

The Ischua Creek Watershed Project Site 6A is located West of Abbott Road approximately 1.0 mile southeast from the center of the Village of Franklinville, New York.

c. Size Classification

The dam is 63 feet high and has a maximum flood storage capacity of 3890 acre-feet at the top of the dam. Therefore, the dam is of intermediate size category by virtue of its height and storage capacity as defined in the Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification

The dam is classified as a high hazard structure due to the presence of the number of homes along the downstream channel and the proximity of the Village of Franklinville.

e. Ownership

The dam is owned, operated and maintained by the Cattaraugus County Watershed District. The local contracting officer is Mr. Ed Smith of Franklinville, New York. His telephone number is 716-676-3427.

f. Purpose of the Dam

The primary purpose of the dam is a floodwater retarding structure. Its secondary purpose is it creates and impounds a recreational lake.

g. Design and Construction History

The design of the dam was performed by the U.S. Department of Agriculture, Soil Conservation Service (SCS), Syracuse, New York. The construction was under the supervision and inspection of the SCS and the general contractor was Eisert Construction Corporation of Olean, New York. The dam was completed in 1971 and the as-built drawings are dated May 19, 1971. The Syracuse office of the SCS has a design folder containing hydrologic, hydraulic, geologic information, as well as soils laboratory test data and slope stability analysis. In addition, as-built drawings and contract documents are maintained by the SCS Syracuse office.

h. Normal Operations Procedure

Normal flows are discharged through the drop inlet structures to the principal spillway outlet pipes. The elevation of the riser crest of the drop inlet structures is 1661.0. Reservoir levels between elevation 1661.0 and the axuiliary spillways crest elevation 1679.0 are discharged through the drop inlet structure. The reservoir has sufficient capacity to store and discharge 740 cfs without discharge occurring in the auxiliary spillway.

1.3 PERTINENT DATA

a. Drainage Areas (sq. mi.)	19
b. Discharge at Damsite (cfs)	
Reservoir Drain at Riser Crest	147.5
Principal Spillway at Auxiliary Spillway Crest(1679.0)	740
Principal Spillway at Maximum High Water (Top of Dam 1687.2)	797
Auxiliary Spillway at Maximum High Water(1687.2)	35,003
Total Spillway Capacity at Maximum High Water (1687.2)	35,800

c. Elevation (ft. above M.S.L.)
as noted in the as-built drawings

Top of Dam	1687.2
Design High Water	1682.9
Auxiliary Spillway Crest	1679.0
Recreation Pool (Normal Pool)	1661.0
Streambed at Dam Centerline	1624.5

d. Reservoir

Length of drainage basin	6.06 miles
Length of normal pool	4500 feet

e. Storage (acre-feet)

Recreation Pool	1110
Crest of Auxiliary Spillway (Flood Storage)	2286
Design High Water (Flood Storage)	3020
Top of Dam (Flood Storage)	3890

f. Reservoir Surface (acres)

Recreation Pool	80
Crest of Auxiliary Spillway	174
Design High Water	190
Top of Dam	218

g. Dam (Taken from as-built drawings and Design Report)

Type: The dam is a homogeneous embankment composed of compacted glacial till with keyed earth cutoff trench and toe drains parallel to dam centerline

Length: (ft)		1043
Height: (ft)		63
Top Width: (ft)		20
Side Slopes:	Upstream (V:H)	1:3
	Downstream (V:H)	1:2.5

Cutoff: Earth Cutoff Trench with compacted embankment material

Grout Curtain: None

h. Principal Spillway

Type: Two (2) 42" I.D. outlet pipes, 3.5'x 10.5' I.D. reinforced concrete drop inlet structures rising 57.5' above base elevation of 1627.0

Total Length of Weir:	38 ft.
Crest Elevation	1661.0
Gates:	Uncontrolled

i. Auxiliary Spillways

Type: Channel cut into soil, trapezoidal cross section, grass lined

Bottom Width: (ft)	East Spillway	250
	West Spillway	200
Side Slopes: (V:H)		1:3
Length of Level or Control Section:		
East Spillway (ft)		30
West Spillway (ft)		20
Entrance Slope:(%)		
East Spillway		1
West Spillway		1
Exit Slope: (%)		
East Spillway		2.2
West Spillway		2.2

j. Reservoir Drain

Type: 30 inch I.D. reinforced concrete pipe

Length: (ft)	104.0

Control: Manually operated vertical slide gate mounted on the east drop inlet structure

SECTION 2: ENGINEERING DATA

2.1 GEOTECHNICAL DATA

a. General Geology

The Ischua Creek damsite number 6A is located southeast of the Village of Franklinville, in southwestern New York State. This area is situated at the northern extremity of the Appalachian Plateau physiographic province.

Local bedrock consists of interbedded shales, siltstones and sandstones of Upper Devonian age. Although the regional dip of strata in this province is gently southwestern, this dip is so slight that, over relatively short distances, the stratigraphy may be considered essentially horizontal.

Overlying the local bedrock are deposits associated with Wisconsin glaciation of the area. These deposits include ground moraine on uplands and slopes, and outwash and alluvial deposits (stratified granular material) filling or forming the floor of active or former stream channels.

Although geologic reconnaissance has revealed no major or active faults in this area, the Village of Franklinville is situated in a region classified between Zone 2 and Zone 3 seismicity, as shown on Figure No. 1 of the Recommended Guidelines for Safety Inspection of Dams. We note, the Attica, New York area located roughly 35 miles to the north has been the site of numerous recent seismic events of moderate intensity.

b. Subsurface Investigation

The subsurface investigation conducted by the SCS consisted of a total of 11 test borings and 31 test pit excavations. Along the dam centerline a total of 3 test borings and 7 test pit excavations were advanced. The investigation for the principal spillway consisted of 3 test pit excavations. A total of 8 test borings and 18

test pit excavations were made for the two auxiliary spillways. Three additional test pit excavations were made along the alignment of the toe drain.

c. Subsurface Conditions

The overburden soils at the dam consist primarily of alluvial silts and gravels in the flood plain overlying dense glacial till at a depth of 8 to 10 feet. Glacial till soils were encountered in both abutments. In the west abutment glacial till overlies the bedrock surface at depths ranging from 4 to 20 feet. Along the east abutment bedrock was not reached within the depth of investigation which extended to a depth of at least 45 feet. The true groundwater table lies between 3 and 5 feet below the former grades along the flood plain. Perched water conditions were encountered in numerous test pits excavated for the auxiliary spillway investigation.

2.2 DESIGN RECORDS

The dam was designed by the Soil Conservation Service, who prepared a design report, contract specifications and engineering drawings. Portions of the design folder have been included with this report as Appendix D. In addition, a number of as-built drawings prepared by the SCS have been included in Appendix E of this report.

2.3 CONSTRUCTION RECORDS

Construction inspection was performed by the SCS and the construction documents are available at the SCS office in Syracuse, New York. Changes from original design are noted on the as-built plans in Appendix E. The most notable change was the raising of the dam by 0.6 feet and reduction of the bottom width of the east auxiliary spillway.

2.4 OPERATION RECORDS

Since the dam was designed as a floodwater retarding structure no operating records are maintained regarding reservoir level or spillway discharge. During

periods of high runoff it is reported that the structure is monitored periodically by SCS personnel and representatives of the Cattaraugus County Watershed District.

2.5 EVALUATION OF DATA

The data presented in this report has been compiled from information obtained from the Soil Conservation Service, Cattaraugus County Watershed Commission and the files of the New York State Department of Environmental Conservation.

The data reviewed in connection with the Phase I inspection were deemed to be adequate and reliable.

SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

a. General

A visual inspection of the dam was conducted on May 5, 6, and 20, 1980. The weather at the time of these inspections was clear with temperatures in the 70's. The reservoir level for May 5 and 6 inspections was at the crest of the drop inlet strucutre, elevation 1661.0. On May 20, 1980 the reservoir had been drawn down for the purpose of inspecting the principal spillway outlet pipes. On this date the reservoir level was at approximately elevation 1656.0.

b. Embankment

The embankment was at the time of inspection in excellent condition, with no signs of misalignment, sloughing, seepage, or cracking. A slight amount of debris in the form of logs was lying on the upstream slope between elevation 1661.0 and 1664.0. A small depression, 2 feet wide by 1 feet deep was detected above the west outlet pipe just south of the concrete wall of the impact basin of that outlet pipe. No evidence of erosion or seepage was detected along either the upstream or downstream abutment-embankment contact. No seepage was detected beyond the toe of the dam, however, a wet area was detected near the contact between berm and the east abutment along the downstream slope.

The internal drainage system consist of drain trenches at the toe of the dam and perforated 10 inch diameter bituminous coated corrugated metal pipe surrounded by filter material which extends from the drain trenches parallel to the dam axis and to the principal spillway outlet pipes. The toe drains outlet into the outlet channel along either side of the impact basins. No discharge was observed from the drains on the inspection dates noted above.

c. Principal Spillway

The principal spillway consists of two (2) reinforced concrete drop inlet structures with the riser crest at elevation 1661.0. Two (2) 42 inch I.D. reinforced concrete pipes, bedded on a concrete cradle, transport reservoir water from the drop structures to the impact basin and outlet channel. The outlet pipe is provided with 7 reinforced concrete anti-seep collars at 24 foot spacings starting 20 feet from the drop inlet structure and ending 178 feet from the drop inlet structures. The outlet pipes and interior sections of the drop inlet structure were in satisfactory condition.

d. Auxiliary Spillways

The auxiliary spillways for this structure are located at the east and west end of the dam. The spillways are cut into glacial till soils. Although the majority of the auxiliary spillways are in cut sections it was necessary to construct a levee along the west side of the east auxiliary spillway extending from the dam centerline north a distance of approximately 250 feet. The inside, or dam side, of both auxiliary slopes has been lined with stone paving. Following earthwork the auxiliary spillways were lined with topsoil and seeded and now support a healthy grass cover. Both spillways were in good condition at the time of the inspection.

e. Reservoir Drain

The reservoir is drained by a 30 inch I.D. reinforced concrete pipe and a manually operated slide gate with the gate stem situated at the top of the east drop inlet structure. The slide gate is in an operable condition, however, when fully closed, leakage estimated at between 10 and 20 gallons per minute passes around the gate.

f. Downstream of Toe

The waste from this dam site is located downstream of the dam along the west side of the outlet channel in the natural flood plain. The area has been graded, covered with topsoil and now supports a healthy growth of grass.

g. Downstream Channel

The downstream channel beyond the impact basin for a distance of 10 feet is lined with rip rap for a depth of 2.7 feet. Beyond the riprap section for a distance of 40 feet, the outlet channel is cut into the former flood plain. Side slopes are 1 vertical on 2.5 horizontal. The outlet channel grades away from the impact basins on a slope of 1 percent for a distance of 50 feet. For a distance of 50 feet beyond the impact basin to the intersection of the existing stream the outlet channel slopes downstream at 0.45 percent. Side slopes for the outlet channel in this section are 1 vertical on 6 horizontal with a minimum width of 100 feet. Some erosion of the riprap lined downstream channel and downstream toe has occurred near the impact basin.

g. Reservoir Area

The area surrounding the reservoir is primarily pasture land and wood lots. The slopes of the area surrounding the reservoir are gentle and estimated to be between 5 and 10 percent with the exception of the entrance to the east auxiliary spillway which has an estimated slope of 1 vertical on 2 horizontal. No signs of slope instability were observed.

3.2 EVALUATION

The visual inspection of this dam revealed the following deficiencies:

1) Debris along the riprap lined section of the upstream slope.
2) A depression 1 foot deep and 2 foot in diameter was noted above the west principal spillway outlet pipe along the south wall of the impact basin.
3) A wet area along the downstream slope in the area of the east abutment-berm contact.
4) Leakage around the reservoir drain slide gate when fully closed, estimated to be between 10-20 gallons per minute.
5) Erosion of downstream toe and riprap lined downstream channel adjacent to the impact basins of the principal spillway.

SECTION 4: OPERATION AND MAINTENANCE PROCEDURE

4.1 PROCEDURES

The normal reservoir level is controlled by the crest elevation of the drop inlet structures. Downstream flow is limited by the flow over the crest of the drop inlet structures during heavy runoff. The principal spillway can discharge 740 cfs without flow occurring in the auxiliary spillways.

4.2 MAINTENANCE OF DAM

The dam is maintained by the Owner, Cattaraugus County Watershed District. Normal maintenance includes mowing the grass of the embankment and auxiliary spillways and removal of debris from the upstream embankment slope.

4.3 WARNING SYSTEM IN EFFECT

There is no warning system in effect, however, the dam is reportedly monitored during periods of heavy runoff by representatives of the SCS and owner.

4.4 EVALUATION

The operation and maintenance procedures for this structure are satisfactory.

SECTION 5: HYDROLOGIC/HYDRAULIC

5.1 DRAINAGE AREA CHARACTERISTICS

Delineation of the watershed draining into the reservoir pool area was made using the USGS 7.5 minute quadrangles for Franklinville and Rawson, New York. The total drainage area measures 19 square miles and consists of both wooded lands and open fields. It should be noted that the flood water from 6.4 square miles of the total drainage area is regulated by another Soil Conservation Service (Site 5) dam before it eventually reaches the reservoir at Site 6A. Relief in the drainage area is moderate to steep with slopes ranging from 8 percent to 25 percent.

5.2 ANALYSIS CRITERIA

The analysis of the floodwater retarding capability of this dam was performed using the Corps of Engineers HEC-1 computer program, Dam Safety Version. This program develops an inflow hydrograph based upon the "Snyder Unit Hydrograph" and then uses the "Modified Puls" flood routing procedure. The spillway design flood selected for analysis was the PMF in accordance with the recommended guidelines of the U.S. Army Corps of Engineers.

5.3 SPILLWAY CAPACITY

The principal spillway system for the dam consists of two parallel drop inlet structures each consisting of a single stage reinforced concrete riser, 42 inch diameter reinforced concrete pipe and a reinforced concrete impact basin to dissipate the energy of high velocity discharge at the outlet end of the pipe. An auxiliary spillway system is designed as an earth cut in each abutment with the control section on compact glacial till. The spillways are of trapezoidal section with bottom widths of 200 feet and 250 feet and side slopes of 1 vertical to 3 horizontal. Principal spillway discharge is controlled by the outlet pipes. Discharge through the auxiliary spillways are calculated assuming a depth of flow at the control section as critical depth.

The spillway system appears to be adequate for discharging the Probable Maximum Flood (PMF). For the PMF, the peak inflow is 32,235 cfs and the peak outflow is 31,729 cfs. The computed spillway capacity for a water surface elevation at the top of dam is 35,800 cfs.

During the PMF storm event the maximum discharge velocity through the auxiliary spillways occurs along the exit slopes and is computed to 11.1 fps and 11.7 fps for the south and north auxiliary spillways, respectively. In addition, the total duration of auxiliary spillway discharge for the PMF event is 28.5 hours.

5.4 RESERVOIR CAPACITY

Storage capacity of the reservoir between the auxiliary spillway crests and the top of the dam is 1604 acre-feet which is equivalent to a runoff depth of 1.54 inches over the total drainage area. The total storage capacity of the dam is 5,000 acre-feet with a maximum flood storage capacity of 3890 acre-feet.

5.5 FLOODS OF RECORD

Due to the lack of reliable information, no attempt was made to estimate the discharge for the flood of record.

5.6 OVERTOPPING POTENTIAL

Analysis using the PMF indicates that the dam has sufficient spillway capacity to discharge the PMF. For a PMF peak outflow of 31,729 cfs, reservoir level would be 0.7 feet below the dam crest elevation.

5.7 EVALUATION

At the PMF the reservoir surface is 0.7 feet below the top of the dam and the height of water in the auxiliary spillway is 7.5 feet. The computed maximum discharge velocities through the auxiliary spillway is in excess of the normally accepted maximum velocity for grass lined spillways of 8 fps. Therefore, the potential of auxiliary spillway erosion exists during periods of heavy runoff.

SECTION 6: STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

No signs of instability were observed in connection with this structure.

b. Design and Construction Data

A total of at least 8 slope stability analyses were performed by SCS for the embankment during the design phase. The soil strength parameters utilized in these analyses were based on consolidated-undrained (R) triaxial shear tests. The tests were conducted on remolded proposed embankment materials compacted to at least 93.5 percent of the maximum dry density attainable through the Standard Proctor Compaction Test (ASTM D-698). The shear strength parameters used in the analyses are as follows:

Sample No.	Internal Friction Angle (degrees)	Cohesion (psf)
65W214	21.5	300
65W217	19.0	425

We note these tests were conducted on remolded material having a gradation less than the No. 4 sieve size.

The stability analyses performed were based on the above shear strength parameters using a modified Swedish slip-circle method. Both the upstream and downstream slopes were analysed using this method under varying conditions.

The results of the stability analyses presented in the Design Report are tabulated below:

Trail No.	Slope	Berm Width	Berm Elevation	Factor of Safety
3	3:1 Upstream	25	1660	1.35
5A & 6B	2 1/2:1 Downstream	16	1650	1.49
8	2 1/2:1 Downstream	10	1650	1.48

NOTE: "Trail Arc Nos. 3,5A & 6 did not penetrate the foundation. Trail No. 8 penetrated the foundation to a depth of 10 feet." For the alluvium foundation the internal friction angle was assumed equal to 35 degrees and zero cohesion.

A review of the recommended design* for a homogeneous earth embankment composed of recompacted glacial till soils indicate that adequate factors of safety against embankment shear failure for the following slope:

Upstream Slope (H:V)	2 1/2:1 to 3:1
Downstream Slope (H:V)	2:1 to 2 1/2:1

We further note the computed factor of safety for the downstream slope of 1.49 is the minimum allowable factor of safety according to the Corps of Engineers Guidelines for the case of steady seepage at maximum storage pool.

In general the stability analyses were based on conservative shear strength parameters because of the gradation of samples tested compared to the embankment composition.

No additional stability analyses were conducted as part of the Phase I Inspection Report.

Design of the crest width and longitudinal camber for settlement considerations as well as the cutoff trench width and depth are in accordance with standard practice. Likewise, the design and construction of the internal drainage system is of conventional design for homogeneous earth embankment dams.

c. Erosion Protection

The design documents do not appear to address in-service erosion protection of the auxiliary spillway channels.

The sodded slopes of the embankment appear to have performed satisfactorily and can be expected to continue to do so.

*"Design of Small Dams", U.S. Department of Interior, Bureau of Reclamation, 1977.

The case of the auxiliary spillways is somewhat less certain, however. The calculated maximum discharge velocity and duration of flow are higher than would normally be considered permissible for sodded channels.

d. Seismic Stability

No seismic stability analysis was performed as performed as part of the dam design.

SECTION 7: ASSESSMENT/RECOMMENDATIONS

7.1 ASSESSMENT

a. Safety

The Phase I inspection of the Ischua Creek Watershed Project Site 6A dam did not reveal conditions which constitute a hazard to human life or property. The earth embankment is considered stable based on the available engineering data and visual observations. The dam and spillways are capable of retarding and discharging floodwater resulting from the Probable Maximum Flood (PMF).

b. Adequacy of Information

The available data reviewed as part of the Phase I inspection is adequate.

c. Need for Additional Investigation

We recommend that the following potential problems be given further investigation or study.

i) A study should be made of the channel velocities in the auxiliary spillways and an evaluation of the need for additional erosion protection.

ii) A field investigation should be made of the source of the wet area which was found at the contact between the downstream berm and the east abutment. The need for any type of corrective measure should be evaluated after this determination is made.

d. Urgency

An emergency preparedness plan for notification and evacuation of downstream residents should be developed and implemented within 6 months. The evaluation of the auxiliary spillway erodability and source of the wet area should be undertaken within 6 months and completed within 18 months.

7.2 RECOMMENDED REMEDIAL MEASURES

a. Remove debris from around drop inlet structures and upstream slope.

b. Place and compact embankment type materials in the depression over the west principal spillway outlet pipe along the south wall of the concrete impact basin.

c. Repair reservoir drain slide gate to insure slide gate is properly seated and no leakage occurs.

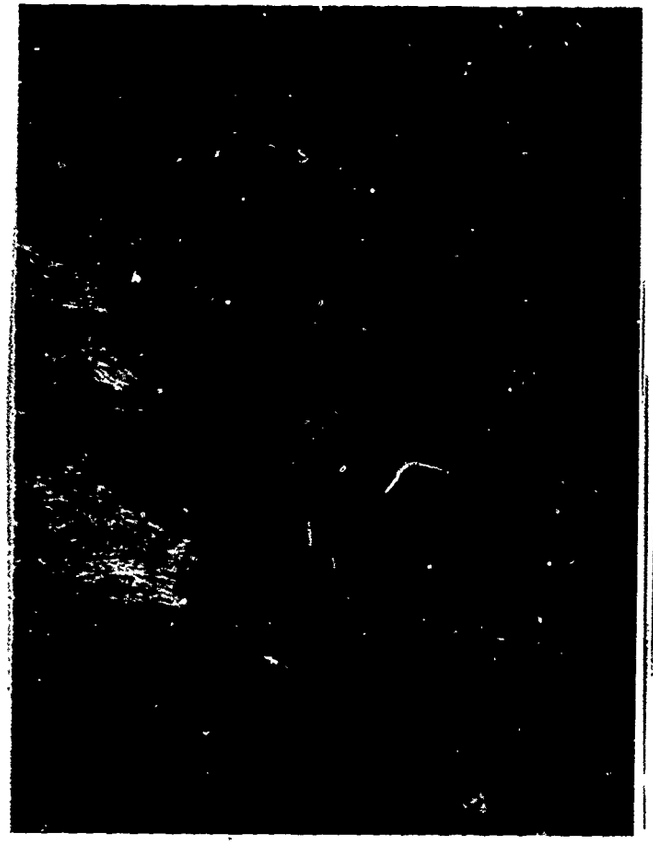
d. Replace riprap along west side of outlet channel adjacent to west impact basin.

e. Develop and implement a warning system and evacuation plan for downstream residents and proper authorities in the event of large auxiliary spillway discharge.

APPENDIX A

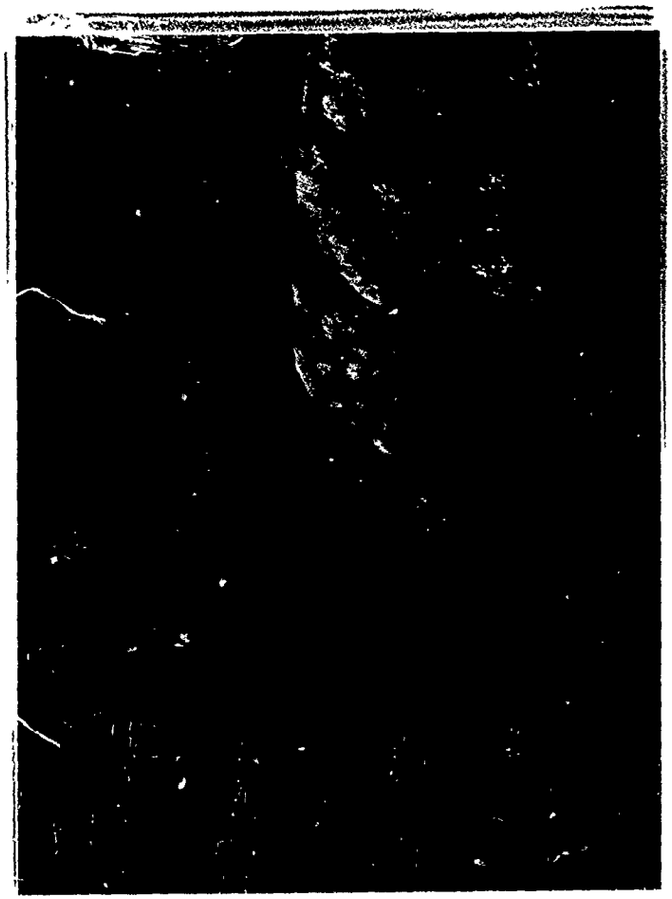
PHOTOGRAPHS

View of upstream slope protection.



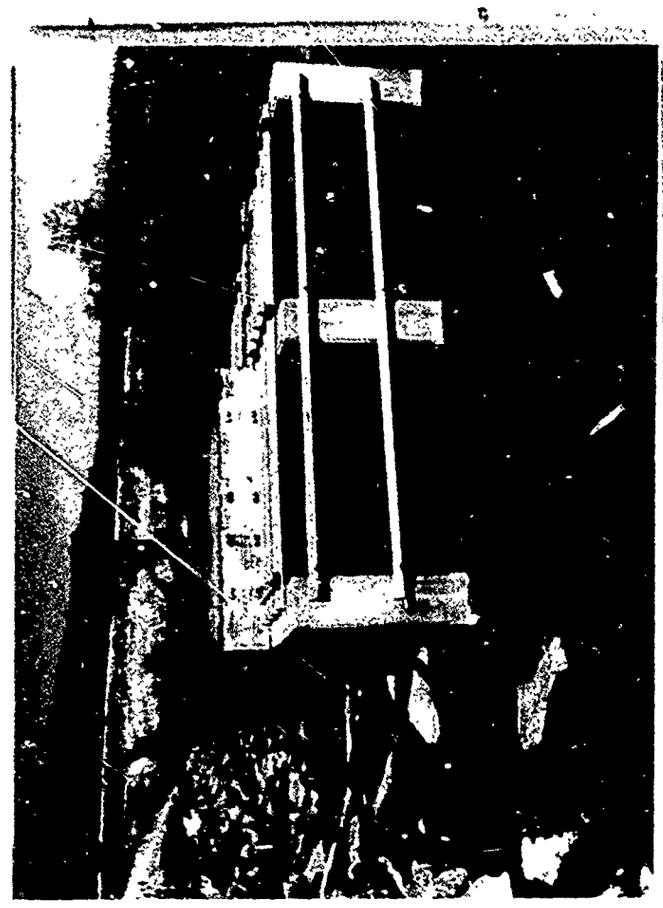
View of upstream embankment slope from west abutment.

View of upstream embankment slope from east spillway.

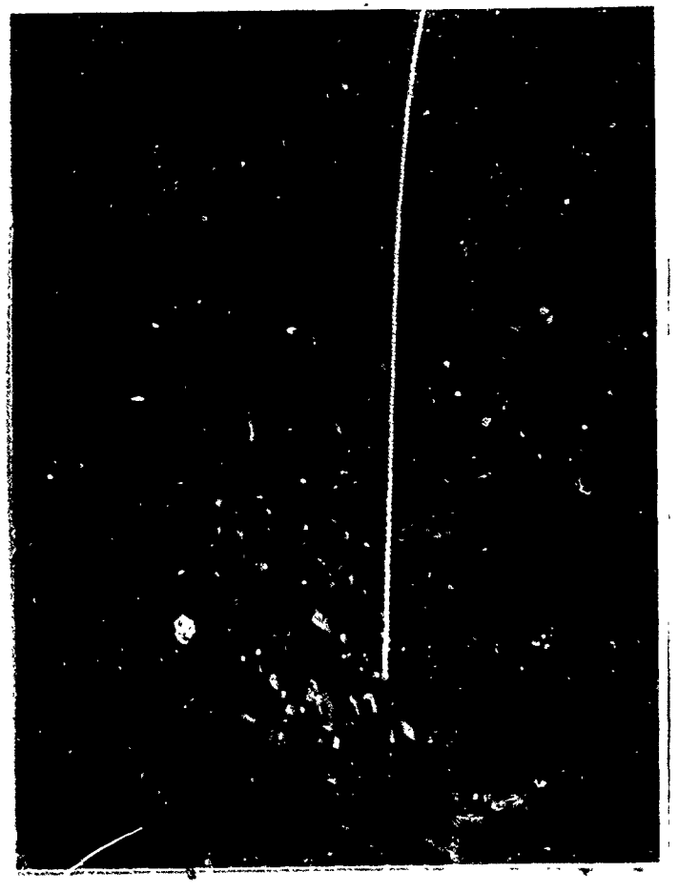


View of downstream embankment slope from west abutment-- mowed (green) strip is berm.

View of intake structures.



Close-up of intake structure and reservoir drain gate operating stem.



Close-up of erosion protection on inside (dam side) spillway shown at right edge of photo above.

Continuation of photo above.

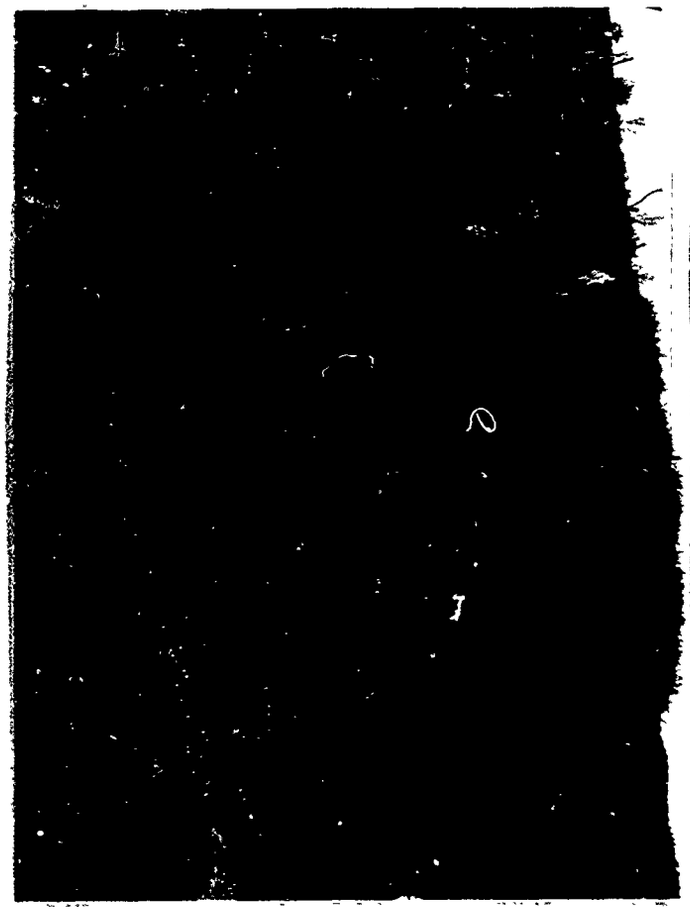
View of west spillway looking downstream.

View of upstream embankment slope and east spillway.

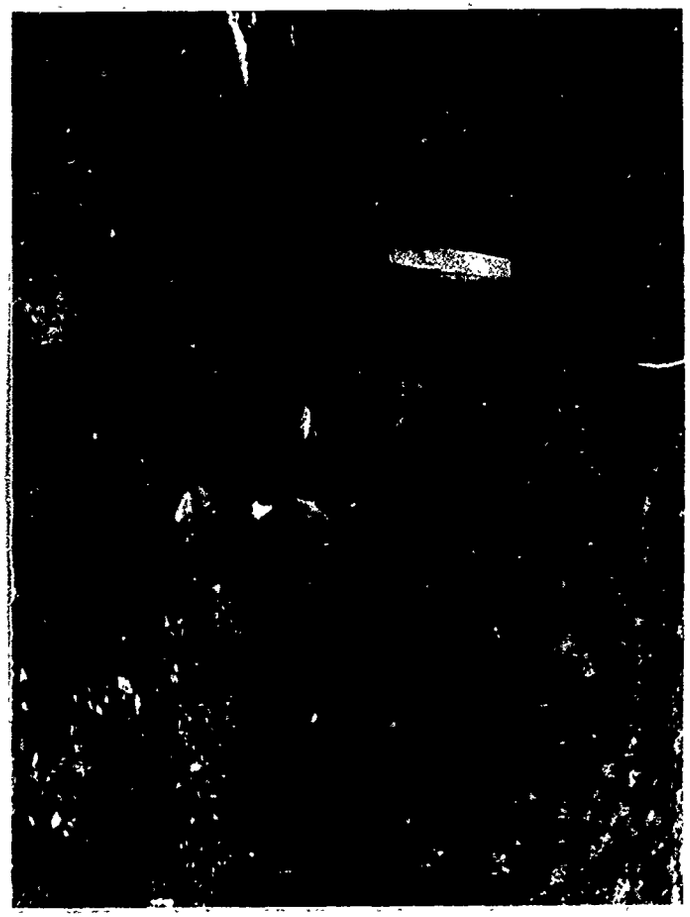
Continuation of photo above.

View of outlet structure from the east side of the stilling basin--also showing toe drain outlets.

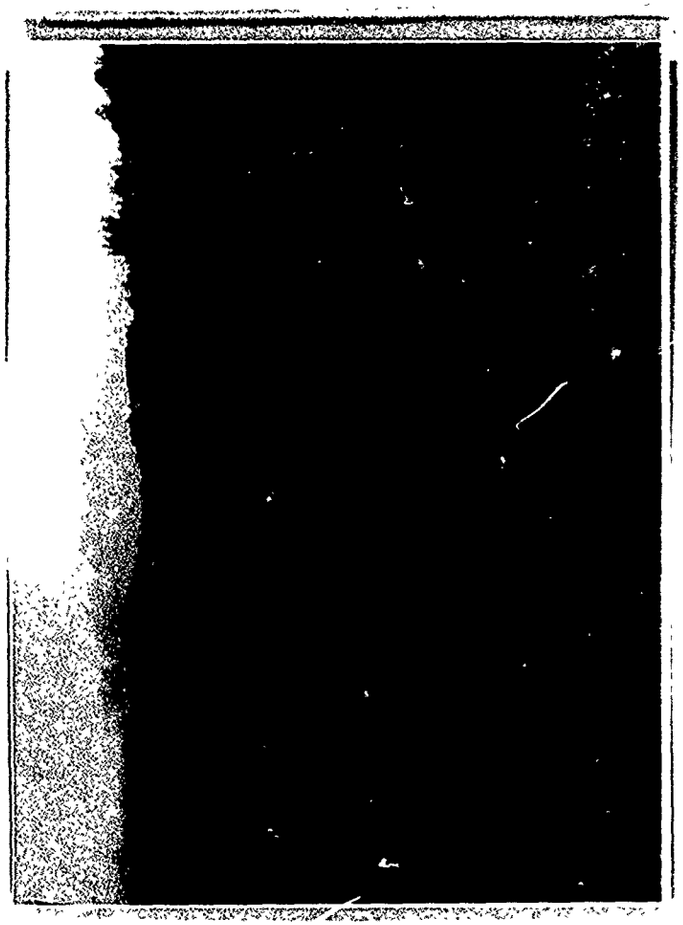
View of downstream channel from crest of dam--reservoir drain closed.



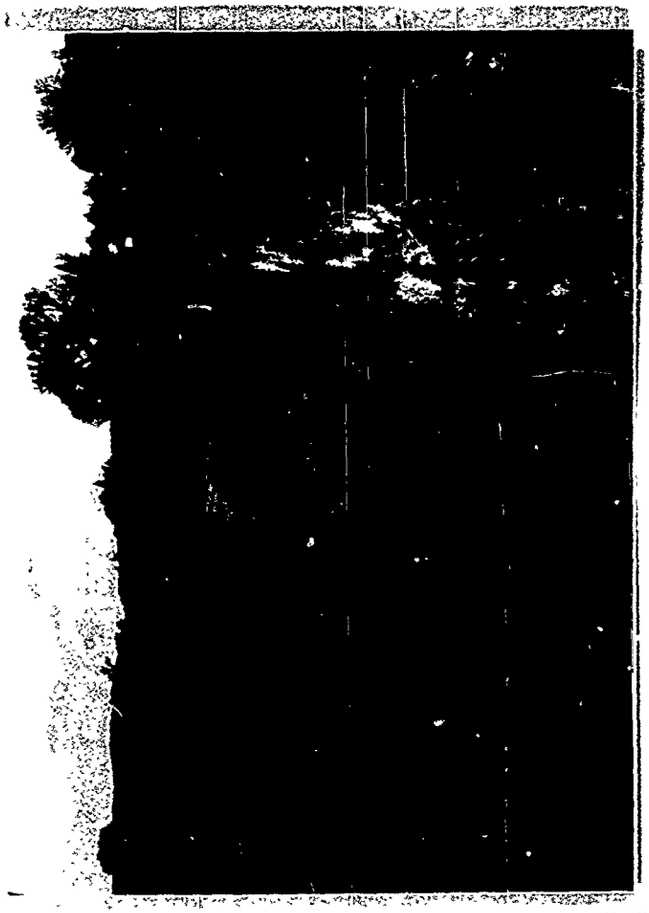
View of erosion on east side of stilling basin.



View of minor erosion along west side of impact basin.



Same view as above with reservoir drain open 9".



View of downstream channel from impact basin.

APPENDIX B

VISUAL INSPECTION CHECKLIST

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VISUAL INSPECTION CHECKLIST

1) Basic Data

a. General

Name of Dam Ischua Creek Site 6A
Fed. I.D. # 25C-3399 DEC. Dam No. NY 571
River Basin Allegheny
Location: Town Franklinville County Cattaraugus
U.S.G.S. Quadrangle Franklinville
Stream Name Gates Creek
Tributary of Ischua Creek
Latitude (N) 42° 19 Longitude (W) 78° 26
Type of Dam Earth Dam
Hazard Category High
Date(s) of Inspection 5/5/80 & 5/6/80, 5/20/80
Weather Conditions Cloudy
Reservoir Level at Time of Inspection 1666.0
Tailwater Level at Time of Inspection 1622.5

b. Inspection Personnel Charles T. Gaynor II - Thomsen Associates
Paul Ehrenberg - Don Lake & Harry Hirsh - SCS
Ed Smith - Cattaraugus Cty. Watershed District 716-676-3427

c. Persons Contacted (Including Address & Phone No.)
Dale Clark - SCS local - 716-699-2326
Robin Worrenster - DEC - Albany - 518-457-5557
Don Lake - SCS - Syracuse Office - 315-423-5503
Harry Hirsh - SCS - Syracuse Office - 315-423-5503

d. History:
Date Constructed Final Acceptance 5/19/71 Date(s) Reconstructed None
Designer Soil Conservation Service
Constructed by Eisert Const Corp Olean, NY
Owner Cattaraugus County Watershed District

e. Seismic Zone Boundary Zone 2 - Zone 3
(See Algermissen, 1969 - Corps of Engineer Guidelines)

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2) Embankment

a. Characteristics

1) Embankment Material: Glacial Till Typical Proportions Gravel - 25%, Sand - 25%, Passing #200 Sieve - 50%

2) Cutoff Type: Trench

3) Impervious Core: None, Dam is Homogenous

4) Internal Drainage System: Drain Trench w/ Toe Drains Drain Pipe Daylights at Spillway Outlet

5) Miscellaneous:

b. Crest

1) Vertical Alignment: Good

2) Horizontal Alignment: Good

3) Surface Cracks: None

4) Miscellaneous:

c. Upstream Slope

1) Slope (Estimate) (V:H): 1:3 to Bench 1650 ft. +- 1:3

2) Undesirable Growth or Debris, Animal Burrows: None

3) Sloughing, Subsidence or Depressions: None

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4) Slope Protection Grass Covered Slope Elevation 0
Riprap 1657.5 to 1664.0 (3' Above & 3' Below Normal Pool Elevation)

5) Surface Cracks or Movement at Toe NONE

d. Downstream Slope

1) Slope (Estimate - V:H) 1.2½ to Berm @ Elev 1650.0 to 1.2½

2) Undesirable Growth or Debris, Animal Burrows NONE

3) Sloughing, Subsidence or Depressions NONE

4) Surface Cracks or Movement at Toe NONE

5) Seepage slightly wet area at contact between toe & berm right abutment area & swale for external drainage (See As Built Plans area is outlined)

6) External Drainage System (Ditches, Trenches; Blanket)
GRASS Lined Drainage Swale

7) Condition Around Outlet Structure Depression 2' Diameter, 1' Deep over ¼ of west outlet pipe adjacent to upslope impact structure
Erosion around Impact Basin

8) Seepage Beyond Toe NONE

e. Abutments-Embankment Contact

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1) Erosion at Contact NONE

2) Seepage Along Contract See Note #5 under downstream slope

3) Drainage System

a. Description of System 2-10" ϕ BCCM Drain Trench to Dam Pipe Embedded in Drain Trench Parallel to ℄ of Dam 100' From Dam ℄

b. Condition of System Un Observable

c. Discharge from Drainage System Very Little (trickle)

4) Instrumentation (Monumentation/Surveys, Observation Wells, Weirs, Piezometers, Etc.)

East Monument Elev. 1719.26 Sta 1+90 on ℄ of Dam
West Monument Elev. 1717.83 Sta. 20+99.3 on ℄ of Dam

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5) Reservoir

a. Slopes 5-10 %

Right Side near entrance to right spillway max slope 1 Vertical on 2 Horizontal

b. Sedimentation Unobservable

c. Unusual Conditions Which Affect Dam

6) Area Downstream of Dam

a. Downstream Hazard (No. of Homes, Highways, etc.) Village of Franklinville (Many Homes) State Rt. 98

b. Seepage, Unusual Growth NONE

c. Evidence of Movement Beyond Toe of Dam NONE

d. Condition of Downstream Channel Clear - Open

Erosion along right bank

7) Spillway(s) (Including Discharge Conveyance Channel)

2- Concrete Drop Inlet Structures with 42" I.D R.C. Outlet Pipes to Impact Basin

a. General

Reservoir Drain Gated on East Inlet Structure

b. Condition of Service Spillway Good, Concrete - Good

No leakage through joints in outlet pipe

All joints inspected 5-20-80

Note: Depression over outlet pipe behind left impact basin.

Erosion Around Inlet Basin

Jackson [illegible] GA
5/20/80 Outlet Pipe
42" ⌀

Sheet 2 of 2

Right Side

Joint #	Crown	West Springline	Invert	East Springline
15	1/4	1/4	1/8	1/8
14	1/8	1/4	1/8	1/8
13	1/2	1/8	—	—
12	3/8	1/4	1/4	1/4
11	1/8	1/4	1/8	1/8
10	—	—	1/8	1/8
9	1/8	—	—	1/8
8	—	1/8	1/8	—
7	1/4	1/4	1/4	3/4
6	1/2	1/2	1/2	1/2
5	1/4	1/4	1	1/8
4	1/4	1/4	—	—
3	—	1/4	1/8	—
2	1/4	1/8	1/8	1/8
1		MORTARED		

Sheet 1 of 2

Left Side

Joint #	TOP Crown	West Springline	Invert	East Springline
15	3/4	1/2	1/2	3/4
14	3/4	3/8	3/8	3/8
13	1/8	1/4	1/8	1/8
12	1/4	1/4	1/4	1/4
11	1/8	1/8	—	—
10	1/8	—	—	1/8
9	1/4	1/4	1/8	1/8
8	1/4	1/4	1/4	1/4
7	1/8	1/4	1/8	1/8
6	1/4	1/4	1/4	1/4
5	1 1/4	1	1/2	1/2
4	1/4	1/4	1/4	1/2
3	1/4	1/4	1/4	1/4
2	—	—	1/4	1/8
1		MORTARED		

— tight

Note: Reservoir Gate doesn't fit tight ≈ 10-20 gpm leakage

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VISUAL INSPECTION CHECKLIST

c. Condition of Auxiliary Spillway(s) Good, However, Heavy Brush near downstream end of East Side Spillway

Max. Elev. 1679.0

d. Condition of Discharge Conveyance Channel OK

8) Reservoir Drain/Outlet

Type: Pipe ✓ Conduit _____ Other _____

Material: Concrete RCP Metal _____ Other _____

Size: 30" I.D Length 104.0

Invert Elevations: Entrance 1628.25 Exit 1622.5 (1628.25 in Drop Inlet, 1622.5 Outlet Pipe)

Physical Condition (Describe): Unobservable ✓

Material: _____

Joints: _____ Alignment _____

Structural Integrity: _____

Hydraulic Capability: _____

Means of Control: Gate ✓ Valve _____ Uncontrolled _____

Operation: Operable ✓ Inoperable _____ Other _____

Present Condition (Describe): Rising Stem, Some Previous Problem with Stem Guides, Slight amount of leakage when closed Est. ≈ 10-20 gpm

Impact Basin Invert - 1619.83

No Warning System or Evacuation Plan

Gate key for Reservoir Drain in Fredericksville Town Hall

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9) Structural

a. Concrete Surfaces Good on Drop Inlet Structures, Impact Basin & Spillway Outlet pipe

b. Structural Cracking None

c. Movement - Horizontal & Vertical Alignment (Settlement) None

d. Junctions with Abutments or Embankments N/A

e. Drains - Foundation, ~~Joint, Face~~ CMP w/ Animal Guards

f. Water Passages, Conduits, Sluices

g. Seepage or Leakage None

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h. Joints - Construction, etc. Outlet Pipe joints VARIED from tight to MAX. spacing of 1¼", joints are designed for 2½ inch Movement, No leakage, No cracks

i. Foundation

j. Abutments

k. Control Gates Reservoir Drain Gate - Rising Stem - Doesn't close tightly, allows 10-20 gpm flow

l. Approach & Outlet Channels

m. Energy Dissipators (Plunge Pool, etc.) Impact Basin for Outlet Pipe

n. Intake Structures Drop Inlet

o. Stability

p. Miscellaneous

APPENDIX C

HYDROLOGIC/HYDRAULIC ENGINEERING DATA AND COMPUTATIONS

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CHECK LIST FOR DAMS HYDROLOGIC AND HYDRAULIC ENGINEERING DATA

AREA-CAPACITY DATA:

	Elevation (ft.)	Surface Area (acres)	TOTAL Storage Capacity (acre-ft.)
1) Top of Dam	1687.2	218	5000.0
2) Design High Water (Max. Design Pool)	1682.9	190	4130.0
3) Auxiliary Spillway Crest	1679.0	174	3396.0
4) Pool Level with Flashboards	N/A.	N.A.	N.A.
5) Service Spillway Crest	1661.0	90	1110.0

DISCHARGES

	Volume (cfs)
1) Average Daily	Unknown
2) Spillway @ Maximum High Water (Top of Dam)	35,300
3) Spillway @ Design High Water	11,600
4) Spillway @ Auxiliary Spillway Crest Elevation	740
5) Low Level Outlet	
6) Total (of all facilities) @ Maximum High Water	35,300
7) Maximum Known Flood	Unknown

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~~OUTLET STRUCTURES~~/EMERGENCY DRAWDOWN FACILITIES:

Type: Gate ✓ Sluice _____ Conduit _____ Penstock _____

Shape: Circular

Size: 30" diameter RCP

Elevations: Entrance Invert 1628.25

Exit Invert 1628.25

Tailrace Channel: Elevation 1622.5

HYDROMETEROLOGICAL GAGES:

Type: None

Location: _____

Records:

Date - _____

Max. Reading - _____

FLOOD WATER CONTROL SYSTEM:

Warning System: None

Method of Controlled Releases (mechanisms):

Reservoir Drain w/ manually controlled slide gate on cast Reop inlet Structure

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CREST: ELEVATION: 1682

Type: Homogeneous Earth Embankment

Width: 20 Length: 1043

Spillover 2 - Drop Inlet Structures & 2 Auxiliary Grass-lined Spillways

Location Drop Inlet Structures near Mid. Section of Embankment
Auxiliary Spillways at east & west end of Dam

SPILLWAY:

PRINCIPAL		EMERGENCY
1661.0	Elevation	1679.0
2 - Parallel Drop Inlet Structures	Type	Trapezoidal Cut in Soil (Geometry)
38 feet	Width	East - 250 feet West - 200 feet
	Type of Control	
✓	Uncontrolled	✓
	Controlled:	
	Type (Flashboards; gate)	
	Number	
	Size/Length	
	Invert Material	Topsoil underlain by Glacial Till
	Anticipated Length of operating service	235 hours @ PMF
240.33' Outlet Pipe	Chute Length	
Not Applicable	Height Between Spillway Crest & Approach Channel Invert (Weir Flow)	Varies East Entrance Slope - 1% West Entrance Slope - 1%

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DRAINAGE AREA: 19.0 sq miles

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type: Wooded & Pasture

Terrain - Relief: Moderate to Steep (8 to 25 %)

Surface - Soil: Glacial Till (Silt, Sand, Gravel)

Runoff Potential (existing or planned extensive alterations to existing surface or subsurface conditions)

Upstream Reservoir (Site 5) Retards Runoff from 6.4 sq mile drainage area, No Planned Changes

Potential Sedimentation problem areas (natural or man-made; present or future)

Design Sedimentation is 139 A-ft. in 50 year from end of Construction.

Potential Backwater problem areas for levels at maximum storage capacity including surcharge storage:

Approximately 350 feet of Hibbotts Road would be inundated along east side of Reservoir during a PMF storm.

Dikes - Floodwalls (overflow & non-overflow) - Low reaches along the Reservoir perimeter:

Location: None

Elevation:

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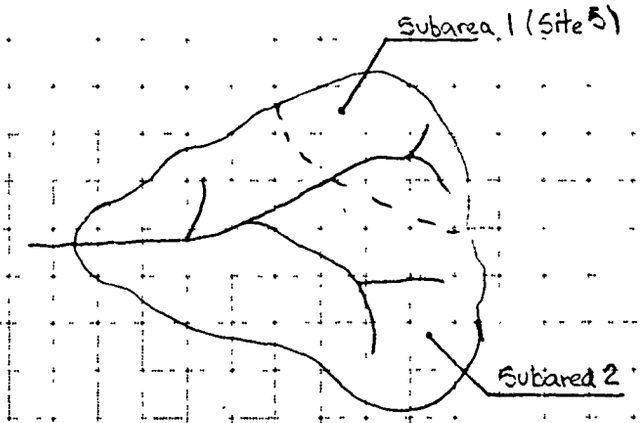
JOB Hydrology Study for ...
SHEET NO _____ OF _____
CALCULATED BY _____ DATE _____
CHECKED BY _____ DATE _____
SCALE _____

Drainage Area

Subarea 1 - 6.4 sq. mile
Subarea 2 - 12.6 sq. mile
Total Area - 19.0 sq mile



Estimation of Lag Time

Subarea - 1

$$t_p = ct\,(.955)(L \cdot L_c)^{.3} + 25\,tR = 1.80(.955)(3.03 \times 1.51)^{.3} + .25(.5)$$
$$= 2.84 \text{ hrs.}$$

$$\text{Slope of Basin} = \frac{2000 - 1780}{10{,}400} \times 100 = 2.1\%$$

Check of Lag Time

Using Linsley, Kohler & Paulus Equation

$$t_p = 0.72\left(\frac{L \cdot L_c}{\sqrt{S}}\right)^{.38} = 0.72\left(\frac{3.03 \times 1.51}{\sqrt{.021}}\right)^{.38} = 2.67 \text{ hr.}$$

Subarea 2

$$t_p = ct(.955)(L \cdot L_c)^{.3} + .25\,tR = .27(.955)(6.06 \times 2.27)^{.3} + .25(.5) = 4.68 \text{ hours}$$

$$\text{Slope of Basin} = \frac{1920 - 1680}{23000} \times 100 = 1.04\%$$

Check of Lag time

Using Linsley, Kohler & Paulhus Equation,

$$t_p = 0.72\left(\frac{L \cdot L_c}{\sqrt{S}}\right)^{.38} = 0.72\left(\frac{6.06 \times 2.27}{\sqrt{.0104}}\right)^{.38} = 4.64 \text{ hrs.}$$

In HEC-1 input for subarea 1 (t_p = 2.84 & c_p = 0.63) and for subarea 2 (t_p = 4.68 & c_p = 0.63) were used to develop Snyder's unit hydrograph

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JOB HYDROLOGIC STUDY DAM #11 571
SHEET NO _____ OF _____
CALCULATED BY P.S. DATE 6/5/80
CHECKED BY _____ DATE _____
SCALE _____

PROBABLE MAXIMUM PRECIPITATION

SUBAREA-1

From Hydrometeorological Report #33, Probable Maximum Precipitation = 22.5 inches (For 200 sq.mile - 24 hr. duration)

Depth - Area - Duration Relationship (Zone 2)

6 hr. = 116%
12 hr. = 127%
24 hr. = 141%

SUBAREA-2

From Hydrometeorological Report #33 Probable Maximum Precipitation = 22.5 inches (For 200 sq.mile - 24 hr. duration)

Depth - Area - Duration Relationship (Zone 2)

6 hr. = 114%
12 hr. = 124%
24 hr. = 137%

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JOB [illegible], Dam #571
SHEET NO ______ OF ______
CALCULATED BY R.W. DATE 6/5/80
CHECKED BY ______ DATE ______
SCALE ______

Stage - Discharge Computation

(Twin Parallel System)

Normal Pool Elevation - 1661.0
Elevation of Crest of Riser - 1661.0
Emergency Spillway Elev. - 1679.0
Elevation of top of Dam - 1686.6
Elevation of Tailwater - 1622.5

Riser Weir Length = 19'
Size of Outlet Pipe = 42" RCP, n = .012
Length of Pipe = 240.33'
Elevation @ Inlet of Pipe - 1627.0

Assumptions:

① To compute the discharge thru the riser, weir flow equation was used for the reservoir stage @ 1663.0. At stages above 1663.0 the headwater at the inlet exceeds the elevation of the crest of riser and discharge is computed thru pipe outlet control.

② Coefficient of Weir = 3.0.

③ Bureau of Public Roads Hydraulic Engineering Circular #5 was used to compute Headwater assuming Inlet & Outlet Control. Long hand calculations were made to compute headwater beyond the limit of the chart.

④ In computing discharge through emergency spillway, approach velocity and friction loss were ignored.

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JOB [illegible] Dam # NY 571
SHEET NO ______ OF ______
CALCULATED BY R.W. DATE 6/5/80
CHECKED BY ______ DATE ______
SCALE ______

Stage - Discharge Computations

Elev.	Stage	Weir Discharge	Inlet Control		Outlet Control			Control HW	Emergency Spillway Discharge	Pipe Discharge	Total Discharge
			Hw/D	Hw	$\frac{d_c+D}{2}$	H	HW				
ft.	ft.	cfs		ft.	ft.	ft.	ft.	ft.	cfs	cfs	cfs
1661.0	0	0	–	–	–	–	–	–	–	0	0
1663.0	2	166	4.0	14.0	3.4	11.5	10.4	14.0	0	332	332
1665.0	4	–*	–	–		39	38	38	0	636	636
1667.0	6	–	–	–	3.5	41	40	40	0	652	652
1669.0	5	–	–	–	3.5	43	42	42	0	668	668
1671.0	10	–	–	–	3.5	45	44	44	0	684	684
1673.0	12	–	–	–	3.5	47	46	46	0	698	698
1675.0	14	–	–	–	3.5	49	48	48	0	714	714
1677.0	16	–	–	–	3.5	51	50	50	0	726	726
1679.0	18	–	–	–	3.5	53	52	52	0	740	740
1681.0	20	–	–	–	3.5	55	54	54	3425	756	4181
1683.0	22	–	–	–	3.5	57	56	56	11,515	770	12,285
1685.0	24	–	–	–	3.5	59	58	58	21,625	784	22,408
1686.6	25.6	–	–	–	3.5	60.6	59.6	59.6	31,170	792	31,962
1687.5	26.5	–	–	–	3.5	61.5	60.5	60.5	37,046 **	799	37,[illegible]

* Outlet Control will govern from elevation 1665.0 and above Discharge [illegible] by $H=\left(1+K_e+\frac{29n^2}{R^{4/3}}\right)\frac{V^2}{2g}$

FORM 204-1 Available from NEBS Inc., Groton Mass 01450

** [illegible] flow [illegible] Dam

McFarland-Johnson Engineers, Inc.
171 Front Street
BINGHAMTON, NEW YORK 13905

JOB Hydrologic Study LAM #1 571
SHEET NO ____ OF ____
CALCULATED BY R. W. DATE 6/5/85
CHECKED BY ____ DATE ____
SCALE ____

Sample Calculations

Riser Discharge

Stage @ 1663.0 $Q = CLH^{3/2}$ - weir flow formula

$C = 3.1$
$L = 19'$
$H = 2'$

$Q = 3.1(19)(2)^{3/2}$
$Q = 166$ cfs

Computed Head with inlet and outlet control indicate that top of riser will not be submerged, thus each pipe will be able to handle 166 cfs., thus total discharge = $2 \times 166 =$ 332 cfs

Pipe Control

At a stage of 1665.0, the computed headwater from the riser discharge was more than the stage elevation. Therefore it was assumed pipe controls and it is outlet control

$HW = H + h_o - L_{so}$
$HW = 1665.0 - 1627.0 = 38'$
$H = 4.5 - 3.5 + 38' = 39'$

$$H = \left(1 + K_e + \frac{29n^2L}{R^{4/3}}\right)\frac{V^2}{2g}$$

$$39 = \left(1 + .1 + \frac{29(.012)^2(240)}{(.875)^{4/3}}\right)\frac{V^2}{64.4}$$

$V = 33.06$

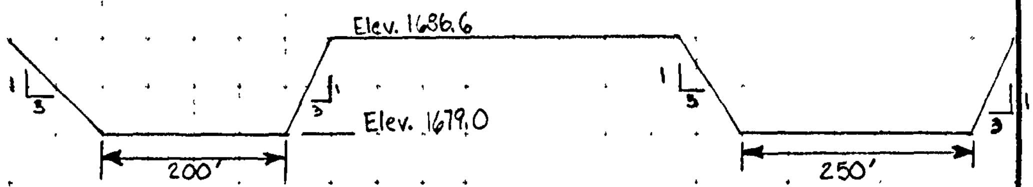
$Q = AV$
$Q = 9.62(33.06)$
$Q = .318$ cfs $\times$ 2 pipes = 636 cfs

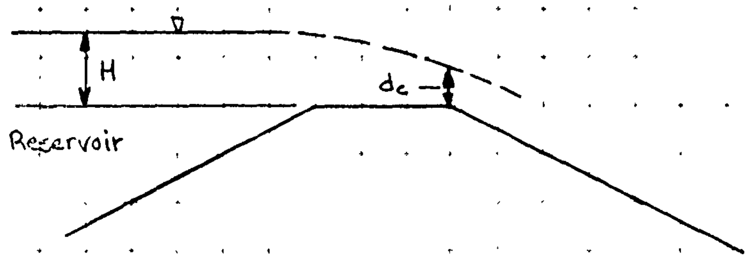
McFarland-Johnson Engineers, Inc.
171 Front Street
BINGHAMTON, NEW YORK 13905

JOB Hydrologic Study Dam #5
SHEET NO ______ OF ______
CALCULATED BY R. W. DATE 3/5/80
CHECKED BY ______ DATE ______
SCALE ______

Emergency Spillway

Stage @ 1681.0





Q thru Pipes,
$H_w = 1681.0 - 1627.0 = 54.0'$ $Q = AV$
$H = 55$ $Q = 9.62(39.3) = 378 \times 2$ pipes $= 756$ cfs
$55 = (2.297)(\frac{V^2}{64.4})$
$V^2 = 1486$
$V = 39.3$

Discharge thru emergency spillways,
$H = 1681.0 - 1679.0 = 2'$

Ignoring approach velocity & friction loss, $H = d_c + \frac{Q_t^2}{2gA_c^2}$

Computations involve assuming a discharge thru each spillway and then calculating d_c and $\frac{Q_t^2}{2gA_c^2}$ Then balance two sides of equation. Table 8-5 of King & Brater "Handbook of Hydraulics was used to compute d_c.

Thru 250' Spillway, Assume $Q = 1800$, $K'_c = .0018$, $d_c/b = .0031$
$d_c = .776$, $\frac{Q_t^2}{2gA_c^2} = 1.223$ $d_c + \frac{Q_t^2}{2gA_c^2} = .776 + 1.22 = 1.996 \cong 2.0$

Thru 200' spillway trapezoidal channel (3:1 side slopes) $Q = 1625$ cfs, $K'_c = .0028$ $d_c/b = .00495$
$d_c = .99$, $\frac{Q_t^2}{2gA_c^2} = .995$ $d_c + \frac{Q_t^2}{2gA_c^2} = 1.985 \cong 2.0$

McFarland-Johnson Engineers, Inc.
171 Front Street
BINGHAMTON, NEW YORK 13905

JOB Hydrologic Study #511
SHEET NO _____ OF _____
CALCULATED BY R.W. DATE 6/6/80
CHECKED BY _____ DATE _____
SCALE _____

Stage - Storage Data

Elevation (ft.)	Surface Area (Acres)	Avg. Area (Acres)	Incremental Storage (Acre-ft.)	Total Storage (Acre ft.)	Remarks
1661.0	80				
1679.0	174	127	2286	2286	Surface areas are directly taken from S.C.S. design report since they are computed with maps of 2 foot and 5 foot contour intervals
1684.2	204	189	983	3269	
1686.6	216	210	504	3773	
1687.5	220	218	200	3975	

McFarland-Johnson Engineers, Inc.
171 Front Street
BINGHAMTON, NEW YORK 13905

JOB Hydrologic Analysis RITES
SHEET NO S.C.S. SITE 5 OF
CALCULATED BY PHE DATE 6/6/87
CHECKED BY DATE
SCALE

Stage-Discharge Computations

Elev.	Stage	Orifice Discharge	Inlet Control		Outlet Control			Control	Riser & Pipe		Emergency-Spillway Discharge	Total Discharge
			HW/D	HW	$\frac{d_c+d}{2}$	H	HW	HW	H	Discharge		
ft.	ft.	cfs		ft.	ft.	ft.	ft.	ft.	ft.	cfs	cfs	cfs
1752	0	0										0
1754	2	18.8										18.8
1756	4	30.4	.6	2.4								30.4
1758	6	38.6	.67	2.7								38.6
1760	8	45.4	.74	3.0								45.4
1762	10	51.3	.8	3.2								51.3
1764	12	56.5	.85	3.4	3.1	.9	1.0	3.4				56.5
1766	14	61.3	.88	3.5	3.15	.94	1.09	3.5				61.3
1768	16	65.8	.93	3.72	3.2	.95	1.15	3.72				65.8
1770	18	70	.98	3.92	3.3	1.20	1.5	3.92				70.0
1772	20	73.9	1.01	4.04	3.35	1.48	1.83	4.04				73.9
1774	22	59	5.65	22.6	4	19.25	20.25	22.6	Riser Control 1.25	226		285
1776	24	19	–	31.44	4	34.78	35.78	35.78	Riser Cntl 3.25	365		384
1778	26	–	–	–	4	38	39	39	Pipe Control 39	400		400
1780	28	–	–	–	4	40	41	41	Pipe Control 41	411		411

McFarland-Johnson Engineers, Inc.
171 Front Street
BINGHAMTON, NEW YORK 13905

JOB Hydrologic Study (TR-20)
SHEET NO S.C.S. SITE 5 OF
CALCULATED BY PHE DATE 6/6/85
CHECKED BY DATE
SCALE

Stage - Discharge Computations (cont.)

Elev	Stage	Orifice Discharge	Inlet Control		Outlet Control			Control	Riser & Pipe		Emergency Spillway	Total
			H_w/D	HW	$\frac{d_{crd}}{2}$	H	HW	HW	H	Discharge	Discharge	Discharge
ft	ft.	cfs		ft.	ft.	ft.	ft.	ft.	ft.	cfs	cfs	cfs
1782	30	—	—	—	4	42	43	43	43	421	0	421
1784	32	—	—	—	4	44	45	45	45	431	2500	2931
1786	34	—	—	—	4	46	47	47	47	441	8000	8441
1788	36	—	—	—	4	48	49	49	49	450	16,300	16,750
1789.2	37.2	—	—	—	4	49.2	50.2	50.2	50.2	456	22,000	22,456

McFarland-Johnson Engineers, Inc.
171 Front Street
BINGHAMTON, NEW YORK 13905

JOB [illegible]

SHEET NO. _____ OF _____

CALCULATED BY PHE DATE 6/6/80

CHECKED BY _____ DATE _____

SCALE _____

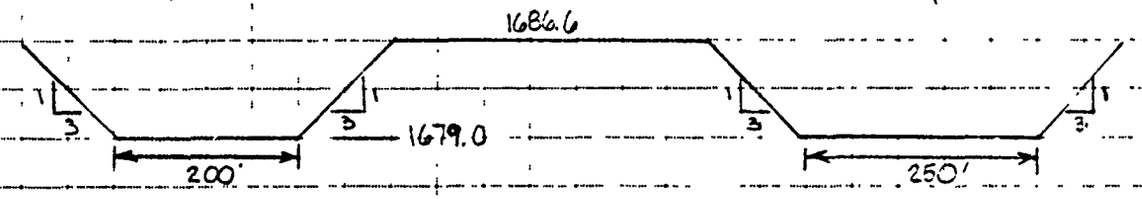
Stage Storage Data

Elevation (ft.)	Surface Area (Acres)	Avg. Area (Acres)	Incremental Storage (Acre-feet)	Total Storage (Acre-ft.)	Remarks
1752	8.5	8.5	0	0	
1755	11.6	10.1	30.3	30.3	
1760	19.4	15.5	77.5	107.8	
1765	27.0	23.2	116.0	223.8	
1770	36.4	31.7	158.5	382.3	
1775	50.8	43.6	218	600.3	
1780	67.1	58.9	294.5	894.8	
1785	82.3	74.7	373.5	1268.3	
1790	95.2	88.8	444	1712.3	

McFarland-Johnson Engineers, Inc.
171 Front Street
BINGHAMTON, NEW YORK 13905

SHEET NO. _____ OF _____
CALCULATED BY _____ DATE _____
CHECKED BY _____ DATE _____
SCALE _____

d/s slope = .022 d/s slope = .022



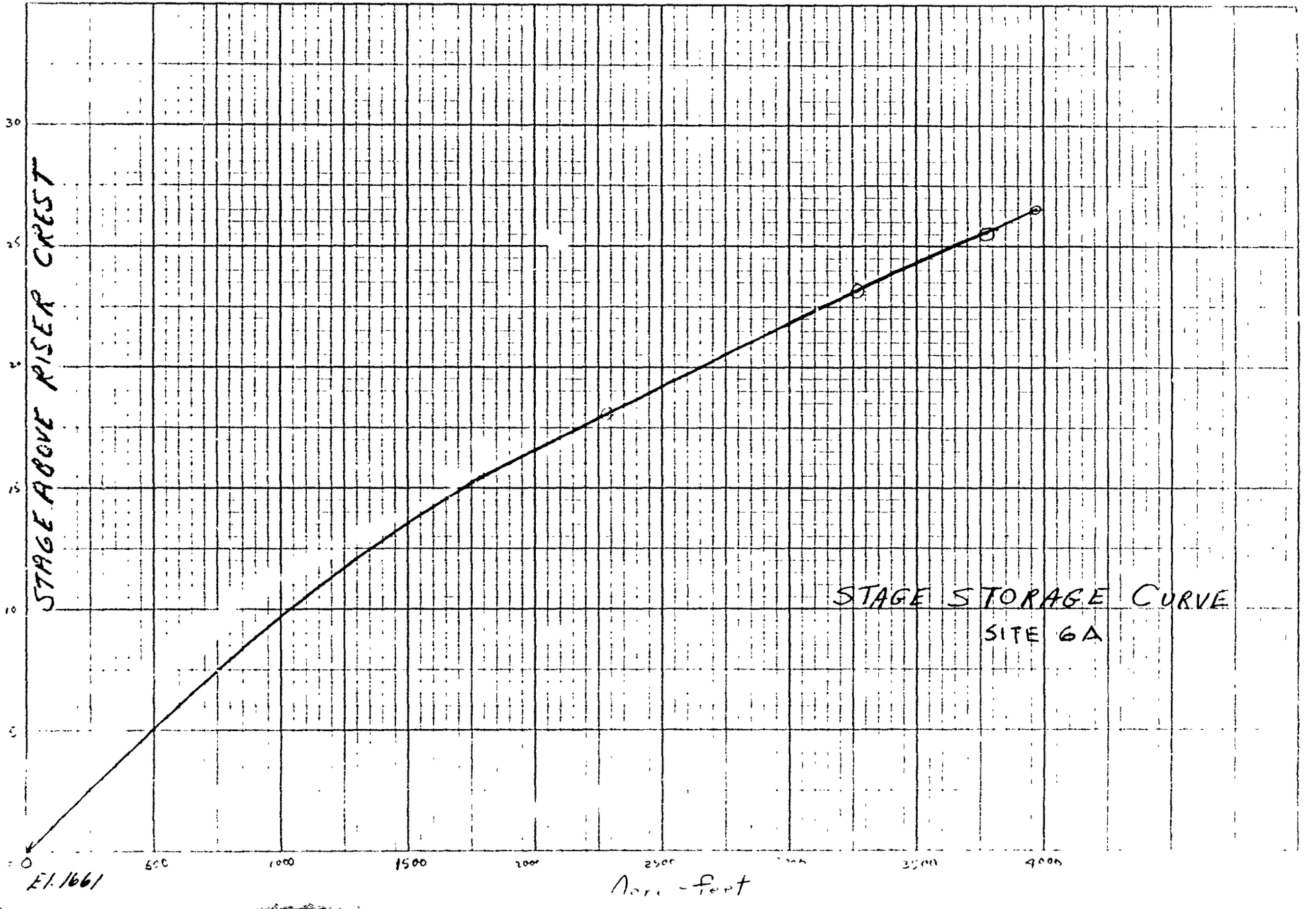
Maximum Discharge thru 2 emergency spillways = 31,170 cfs @ 1686.6

Q = 14,000 cfs thru 200' bw trapezoidal channel
Q = 17,170 cfs thru 250' bw " "

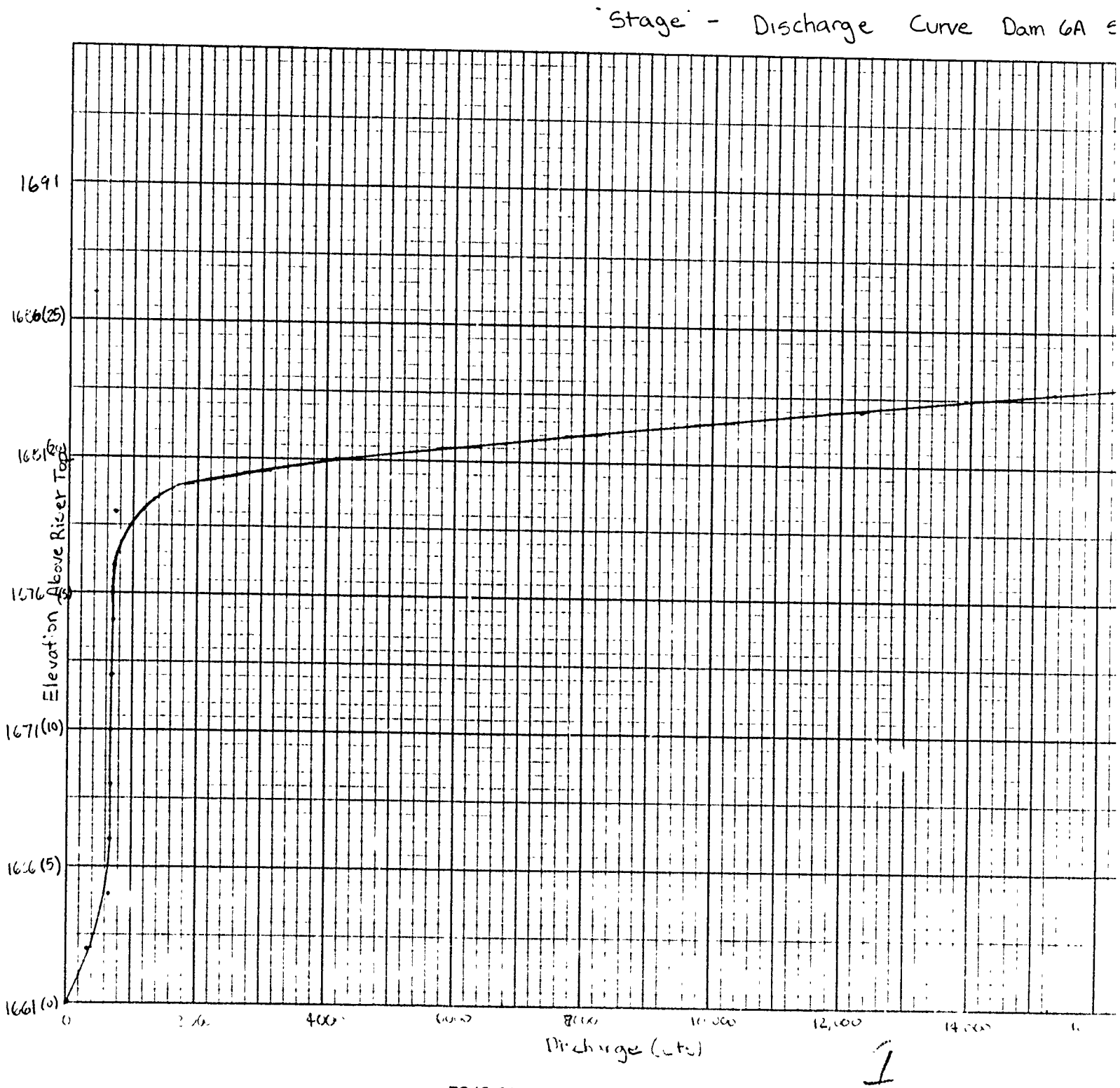
$K' = \frac{14{,}000 \times .06}{(200)^{3/2}(.022)^{1/2}} = .0041$ $K' = \frac{17{,}170 \times .06}{(250)^{3/2}(.022)^{1/2}} = .0028$

$d_n = .029(200) = 5.8'$ $d_n = .022(250) = 5.5'$

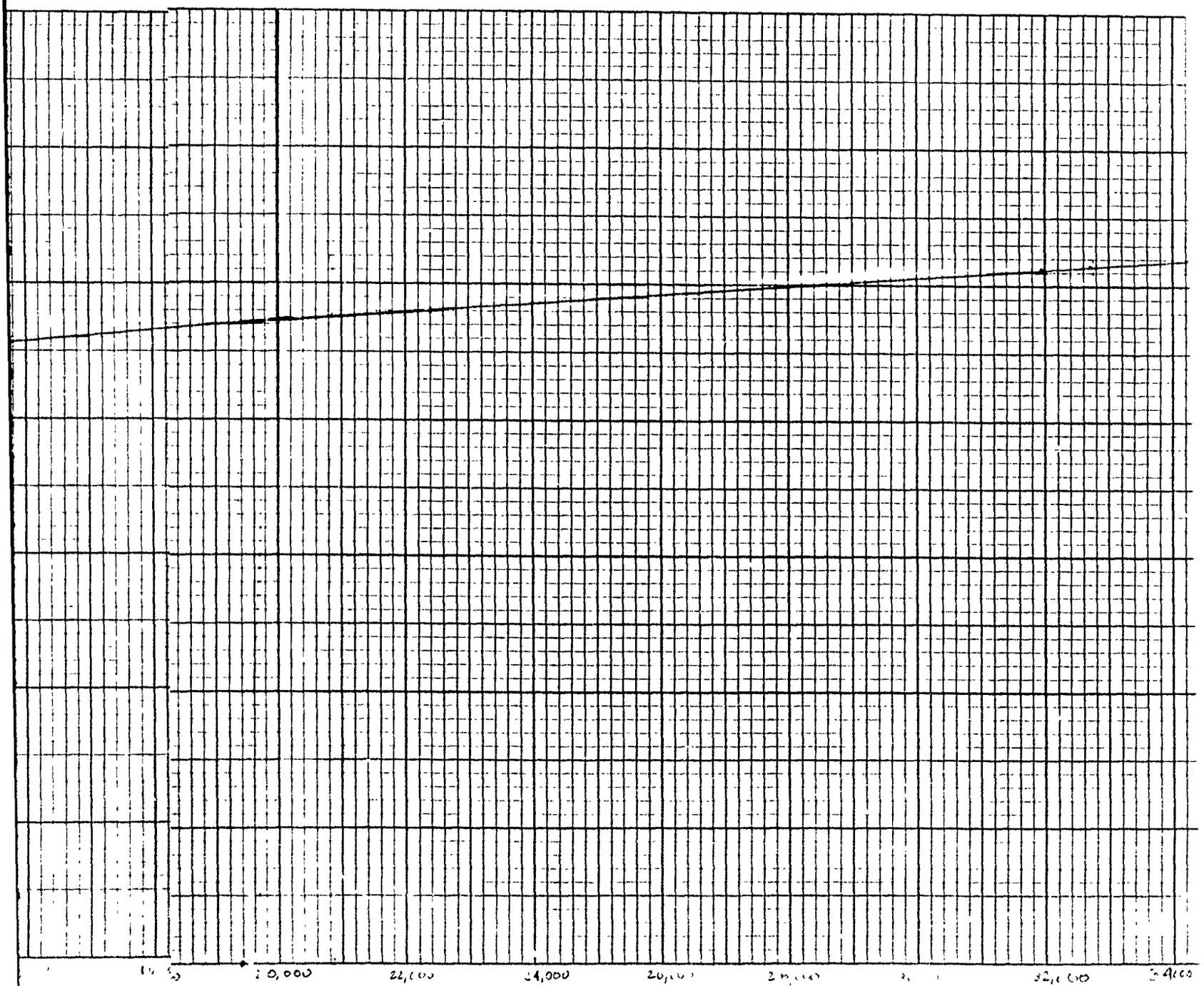
$V_n = \frac{14{,}000}{1260.9} = 11.1'/sec$ $V_n = 17{,}170 / 1465.7 = 11.71'/sec$



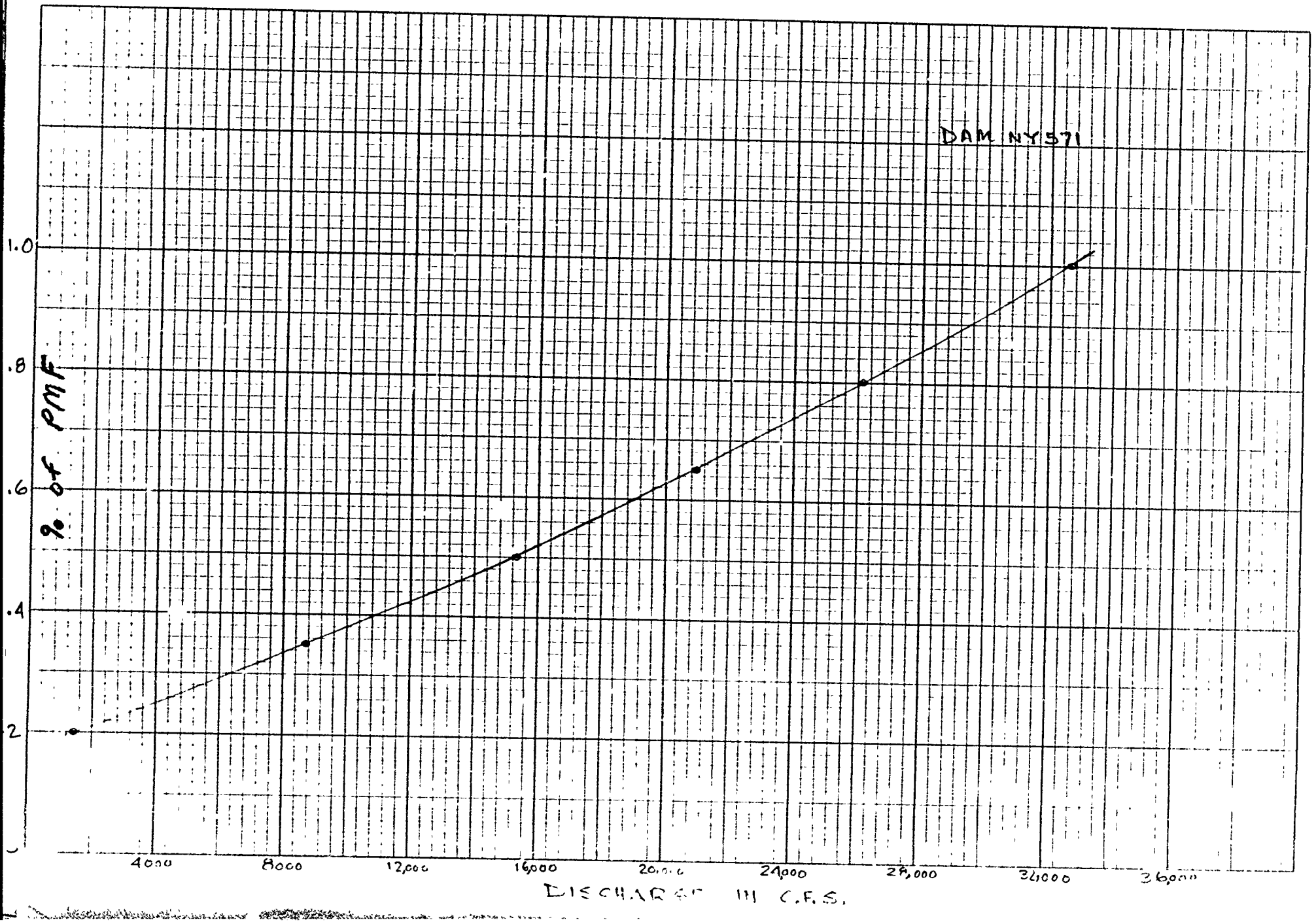
STAGE STORAGE CURVE
SITE 6A


'Stage' - Discharge Curve Dam 6A
1691
1686(25)
1681(20)
1676(15)
1671(10)
1666(5)
1661(0)
Elevation Above Riser Top
0
2,000
4000
6000
8000
10,000
12,000
14,000
Discharge (cfs)

SCS



46 0782



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**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********************************
A1                 ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
A2                HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF NY 571
A3                  RATIOS OF PMF ROUTED THROUGH THE RESERVOIR
B      150       0      30       0       0       0       0       0       0       0
B1       5
J        1       0       1
J1      .2     .35     .50     .65     .80       1
K        0       1       0       0       0       0       1
K1         CALCULATION OF INFLOW HYDROGRAPH SUBAREA 1
M        1       1     6.4       0     6.4       0       0       0       0       0
P        0    22.5     116     127     141       0       0       0       0       0
T        0       0       0       0       0       0       1      .1       0       0
W     2.84     .03
X       -2     -.1       2
K        1       2       0       0       0       0       1       0       0       0
K1         ROUTING OF INFLOW HYDROGRAPH
Y        0       0       0       1       1
Y1       1       0       0       0       0       0      -1
Y2       0      40     108     250     460     552     659     755    1045    1195
Y2    1345    1515    1625
Y3       0    30.4    45.4    61.3    73.9     285     383     400     421    2931
Y3    8441   16755   22456
K        0       2       0       0       0       0       1
K1                 CALCULATION OF INFLOW HYDROGRAPH SUBAREA 2
M        1       1    12.6       0    12.6       0       0       0       0
P        0    22.5     114     124     137
T        0       0       0       0       0       0       1      .1       0       0
W     4.58     .03
X       -2     -.1       2
K        2       2                                       1
K1         COMBINE HYDROGRAPHS SUBAREA 1 AND SUBAREA 2
K        1       3                                       1
K1         ROUTING OF INFLOW HYDROGRAPH
Y        0       0       0       1       1
Y1       1       0       0       0       0       0      -1
Y2       0     200     600    1050    1575    2285    2650    3040    3430    3775
Y2    3975
Y3       0     332     652     684     714     740    4181   12285   22108   31962
Y3   37545
K       99
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	1
ROUTE HYDROGRAPH TO	2
RUNOFF HYDROGRAPH AT	2
COMBINE 2 HYDROGRAPHS AT	2
ROUTE HYDROGRAPH TO	3
END OF NETWORK	

****
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79
****

TIME OF EXECUTION 15-JUN-80 11:04:00

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF NY 571
RATIOS OF PMF ROUTED THROUGH THE RESERVOIR

JOB SPECIFICATION

NW	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
150	0	30	0	0	0	0	0	0	0
			JOPER	NMT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 6 LRTIO= 1
RTIOS= 0.20 0.35 0.50 0.65 0.80 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

CALCULATION OF INFLOW HYDROGRAPH SUBAREA 1

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	6.40	0.00	6.40	0.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.50	116.00	127.00	141.00	0.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.10	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 2.64 CP=0.63 NTA= 0

RECESSION DATA
STRTQ= -2.00 QRCSN= -0.10 RTIOR= 2.00
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 6.50 AND R= 5.20 INTERVALS

UNIT HYDROGRAPH 31 END-OF-PERIOD ORDINATES, LAG= 2.85 HOURS, CP= 0.63 VOL= 1.00

62.	420.	715.	872.	843.	918.	871.	740.	610.	503.
415.	342.	282.	233.	192.	158.	130.	108.	89.	73.
60.	50.	41.	34.	28.	23.	19.	16.	13.	11.
9.									

END-OF-PERIOD FLOW

NO.	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	NO.	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	0.30	1	0.08	0.00	0.08	12.	1.02	14.00	76	0.00	0.00	0.00	280.
1.01	1.00	2	0.08	0.00	0.08	11.	1.02	14.30	77	0.00	0.00	0.00	261.
1.01	1.30	3	0.08	0.00	0.08	10.	1.02	15.00	78	0.00	0.00	0.00	244.
1.01	2.00	4	0.08	0.00	0.08	10.	1.02	15.30	79	0.00	0.00	0.00	228.
1.01	2.30	5	0.08	0.00	0.08	9.	1.02	16.00	80	0.00	0.00	0.00	212.
1.01	3.00	6	0.08	0.00	0.08	8.	1.02	16.30	81	0.00	0.00	0.00	198.
1.01	3.30	7	0.08	0.00	0.08	8.	1.02	17.00	82	0.00	0.00	0.00	185.
1.01	4.00	8	0.08	0.00	0.08	7.	1.02	17.30	83	0.00	0.00	0.00	172.
1.01	4.30	9	0.08	0.00	0.08	7.	1.02	18.00	84	0.00	0.00	0.00	161.
1.01	5.00	10	0.08	0.00	0.08	6.	1.02	18.30	85	0.00	0.00	0.00	150.
1.01	5.30	11	0.08	0.00	0.08	6.	1.02	19.00	86	0.00	0.00	0.00	140.
1.01	6.00	12	0.08	0.00	0.08	6.	1.02	19.30	87	0.00	0.00	0.00	131.
1.01	6.30	13	0.17	0.12	0.05	13.	1.02	20.00	88	0.00	0.00	0.00	122.
1.01	7.00	14	0.17	0.12	0.05	39.	1.02	20.30	89	0.00	0.00	0.00	114.
1.01	7.30	15	0.17	0.12	0.05	91.	1.02	21.00	90	0.00	0.00	0.00	106.
1.01	8.00	16	0.17	0.12	0.05	168.	1.02	21.30	91	0.00	0.00	0.00	99.
1.01	8.30	17	0.17	0.12	0.05	265.	1.02	22.00	92	0.00	0.00	0.00	92.
1.01	9.00	18	0.17	0.12	0.05	371.	1.02	22.30	93	0.00	0.00	0.00	86.
1.01	9.30	19	0.17	0.12	0.05	470.	1.02	23.00	94	0.00	0.00	0.00	80.
1.01	10.00	20	0.17	0.12	0.05	554.	1.02	23.30	95	0.00	0.00	0.00	75.
1.01	10.30	21	0.17	0.12	0.05	624.	1.03	0.00	96	0.00	0.00	0.00	70.
1.01	11.00	22	0.17	0.12	0.05	681.	1.03	0.30	97	0.00	0.00	0.00	65.
1.01	11.30	23	0.17	0.12	0.05	729.	1.03	1.00	98	0.00	0.00	0.00	61.
1.01	12.00	24	0.17	0.12	0.05	766.	1.03	1.30	99	0.00	0.00	0.00	57.
1.01	12.30	25	1.04	0.99	0.05	854.	1.03	2.00	100	0.00	0.00	0.00	53.
1.01	13.00	26	1.04	0.99	0.05	1079.	1.03	2.30	101	0.00	0.00	0.00	50.
1.01	13.30	27	1.25	1.20	0.05	1505.	1.03	3.00	102	0.00	0.00	0.00	46.
1.01	14.00	28	1.25	1.20	0.05	2161.	1.03	3.30	103	0.00	0.00	0.00	43.
1.01	14.30	29	1.57	1.52	0.05	3029.	1.03	4.00	104	0.00	0.00	0.00	40.
1.01	15.00	30	1.57	1.52	0.05	4059.	1.03	4.30	105	0.00	0.00	0.00	38.
1.01	15.30	31	1.90	1.85	0.05	5171.	1.03	5.00	106	0.00	0.00	0.00	35.
1.01	16.00	32	6.03	5.98	0.05	6503.	1.03	5.30	107	0.00	0.00	0.00	33.
1.01	16.30	33	1.46	1.41	0.05	8351.	1.03	6.00	108	0.00	0.00	0.00	30.
1.01	17.00	34	1.46	1.41	0.05	10274.	1.03	6.30	109	0.00	0.00	0.00	28.
1.01	17.30	35	1.15	1.10	0.05	12048.	1.03	7.00	110	0.00	0.00	0.00	27.
1.01	18.00	36	1.15	1.10	0.05	13340.	1.03	7.30	111	0.00	0.00	0.00	25.
1.01	18.30	37	0.13	0.08	0.05	13895.	1.03	8.00	112	0.00	0.00	0.00	23.
1.01	19.00	38	0.13	0.08	0.05	13539.	1.03	8.30	113	0.00	0.00	0.00	22.
1.01	19.30	39	0.13	0.08	0.05	12461.	1.03	9.00	114	0.00	0.00	0.00	20.
1.01	20.00	40	0.13	0.08	0.05	11090.	1.03	9.30	115	0.00	0.00	0.00	19.
1.01	20.30	41	0.13	0.08	0.05	9629.	1.03	10.00	116	0.00	0.00	0.00	18.
1.01	21.00	42	0.13	0.08	0.05	8189.	1.03	10.30	117	0.00	0.00	0.00	16.
1.01	21.30	43	0.13	0.08	0.05	6885.	1.03	11.00	118	0.00	0.00	0.00	15.
1.01	22.00	44	0.13	0.08	0.05	5787.	1.03	11.30	119	0.00	0.00	0.00	14.
1.01	22.30	45	0.13	0.08	0.05	4881.	1.03	12.00	120	0.00	0.00	0.00	13.
1.01	23.00	46	0.13	0.08	0.05	4135.	1.03	12.30	121	0.00	0.00	0.00	12.
1.01	23.30	47	0.13	0.08	0.05	3519.	1.03	13.00	122	0.00	0.00	0.00	12.
1.02	0.00	48	0.13	0.08	0.05	3011.	1.03	13.30	123	0.00	0.00	0.00	11.
1.02	0.30	49	0.00	0.00	0.00	2588.	1.03	14.00	124	0.00	0.00	0.00	10.
1.02	1.00	50	0.00	0.00	0.00	2225.	1.03	14.30	125	0.00	0.00	0.00	9.
1.02	1.30	51	0.00	0.00	0.00	1906.	1.03	15.00	126	0.00	0.00	0.00	9.
1.02	2.00	52	0.00	0.00	0.00	1621.	1.03	15.30	127	0.00	0.00	0.00	8.
1.02	2.30	53	0.00	0.00	0.00	1380.	1.03	16.00	128	0.00	0.00	0.00	8.
1.02	3.00	54	0.00	0.00	0.00	1287.	1.03	16.30	129	0.00	0.00	0.00	7.
1.02	3.30	55	0.00	0.00	0.00	1201.	1.03	17.00	130	0.00	0.00	0.00	7.
1.02	4.00	56	0.00	0.00	0.00	1121.	1.03	17.30	131	0.00	0.00	0.00	6.
1.02	4.30	57	0.00	0.00	0.00	1046.	1.03	18.00	132	0.00	0.00	0.00	6.
1.02	5.00	58	0.00	0.00	0.00	976.	1.03	18.30	133	0.00	0.00	0.00	5.

1.02	5.30	59	0.00	0.00	0.00	910.	1.03	19.00	134	0.00	0.00	0.00	5.
1.02	6.00	60	0.00	0.00	0.00	849.	1.03	19.30	135	0.00	0.00	0.00	5.
1.02	6.30	61	0.00	0.00	0.00	793.	1.03	20.00	136	0.00	0.00	0.00	4.
1.02	7.00	62	0.00	0.00	0.00	739.	1.03	20.30	137	0.00	0.00	0.00	4.
1.02	7.30	63	0.00	0.00	0.00	690.	1.03	21.00	138	0.00	0.00	0.00	4.
1.02	8.00	64	0.00	0.00	0.00	644.	1.03	21.30	139	0.00	0.00	0.00	4.
1.02	8.30	65	0.00	0.00	0.00	601.	1.03	22.00	140	0.00	0.00	0.00	3.
1.02	9.00	66	0.00	0.00	0.00	560.	1.03	22.30	141	0.00	0.00	0.00	3.
1.02	9.30	67	0.00	0.00	0.00	523.	1.03	23.00	142	0.00	0.00	0.00	3.
1.02	10.00	68	0.00	0.00	0.00	488.	1.03	23.30	143	0.00	0.00	0.00	3.
1.02	10.30	69	0.00	0.00	0.00	455.	1.04	0.00	144	0.00	0.00	0.00	3.
1.02	11.00	70	0.00	0.00	0.00	425.	1.04	0.30	145	0.00	0.00	0.00	2.
1.02	11.30	71	0.00	0.00	0.00	396.	1.04	1.00	146	0.00	0.00	0.00	2.
1.02	12.00	72	0.00	0.00	0.00	370.	1.04	1.30	147	0.00	0.00	0.00	2.
1.02	12.30	73	0.00	0.00	0.00	345.	1.04	2.00	148	0.00	0.00	0.00	2.
1.02	13.00	74	0.00	0.00	0.00	322.	1.04	2.30	149	0.00	0.00	0.09	2.
1.02	13.30	75	0.00	0.00	0.00	300.	1.04	3.00	150	0.00	0.00	0.00	2.
									SUM	25.38	22.58	2.80	199249.
										(645.)	(573.)	(71.)	(5642.10)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	13695.	10490.	3908.	1384.	199245.
CMS	393.	297.	112.	39.	5642.
INCHES		15.25	23.07	24.13	24.13
MM		387.27	585.91	612.96	612.99
AC-FT		5202.	7870.	8233.	8233.
THOUS CU M		6416.	9707.	10155.	10156.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 1

2.	2.	2.	2.	2.	2.	1.	1.	1.
1.	1.	3.	8.	18.	34.	53.	74.	94.	111.
125.	136.	146.	154.	171.	216.	301.	432.	606.	812.
1034.	1313.	1670.	2065.	2410.	2668.	2779.	2708.	2492.	2218.
1926.	1636.	1377.	1157.	976.	827.	704.	602.	518.	445.
381.	324.	276.	257.	240.	224.	209.	195.	182.	170.
159.	148.	138.	129.	120.	112.	105.	98.	91.	85.
79.	74.	69.	64.	60.	56.	52.	49.	46.	42.
40.	37.	34.	32.	30.	28.	26.	24.	23.	21.
20.	18.	17.	16.	15.	14.	13.	12.	11.	11.
10.	9.	9.	8.	8.	7.	7.	6.	6.	5.
5.	5.	4.	4.	4.	4.	3.	3.	3.	3.
2.	2.	2.	2.	2.	2.	2.	2.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2779.	2096.	794.	277.	39849.
CMS	79.	59.	22.	8.	1128.
INCHES		3.05	4.61	4.83	4.83
MM		77.45	117.18	122.59	122.60
AC-FT		1040.	1574.	1647.	1647.
THOUS CU M		1283.	1941.	2031.	2031.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 2

4.	4.	4.	3.	3.	3.	3.	2.	2.
2.	2.	5.	14.	32.	59.	93.	130.	165.	194.

218.	234.	255.	269.	299.	376.	527.	756.	1060.	1421.
1610.	2297.	2923.	3590.	4217.	4869.	4863.	4739.	4361.	3882.
3370.	2906.	2410.	2025.	1709.	1447.	1232.	1054.	906.	779.
667.	567.	483.	451.	420.	392.	366.	341.	319.	297.
277.	259.	241.	225.	210.	196.	183.	171.	159.	149.
139.	129.	121.	113.	105.	98.	92.	85.	80.	74.
69.	65.	60.	56.	53.	49.	46.	43.	40.	37.
35.	32.	30.	28.	26.	25.	23.	21.	20.	19.
17.	16.	15.	14.	13.	12.	11.	11.	10.	9.
9.	8.	8.	7.	7.	6.	6.	5.	5.	5.
4.	4.	4.	4.	3.	3.	3.	3.	2.	2.
2.	2.	2.	2.	2.	2.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4803.	3671.	1389.	484.	69736.
CMS	136.	104.	39.	14.	1975.
INCHES		5.34	8.07	8.45	8.45
MM		135.54	205.07	214.53	214.55
AC-FT		1321.	2754.	2881.	2882.
THOUS CU M		2246.	3397.	3554.	3554.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 3

6.	6.	6.	6.	6.	4.	4.	4.	3.	3.
3.	3.	7.	20.	45.	84.	133.	185.	235.	277.
312.	341.	364.	384.	427.	539.	752.	1080.	1515.	2030.
2568.	3281.	4170.	5137.	6074.	6670.	6948.	6769.	6231.	5545.
4814.	4094.	3443.	2894.	2441.	2067.	1759.	1505.	1294.	1113.
953.	810.	690.	644.	601.	560.	523.	488.	455.	425.
396.	370.	345.	322.	300.	280.	261.	244.	228.	212.
198.	185.	172.	161.	150.	140.	131.	122.	114.	106.
99.	92.	86.	80.	75.	70.	65.	61.	57.	53.
50.	46.	43.	40.	38.	35.	33.	30.	28.	27.
25.	23.	22.	20.	19.	18.	16.	15.	14.	13.
12.	12.	11.	10.	9.	9.	8.	8.	7.	7.
6.	6.	5.	5.	5.	4.	4.	4.	4.	3.
3.	3.	3.	3.	2.	2.	2.	2.	2.	2.
2.	1.	1.	1.	1.	1.	1.	1.	1.	1.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6948.	5245.	1984.	692.	99623.
CMS	197.	149.	56.	20.	2821.
INCHES		7.62	11.53	12.07	12.07
MM		193.63	292.96	306.48	306.49
AC-FT		2601.	3935.	4116.	4117.
THOUS CU M		3208.	4854.	5078.	5078.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 4

8.	7.	7.	6.	6.	5.	5.	5.	4.	4.
4.	4.	6.	20.	59.	109.	173.	241.	306.	360.
400.	443.	474.	499.	555.	701.	978.	1404.	1969.	2638.
3301.	4266.	5428.	6678.	7832.	8671.	9032.	8800.	8100.	7209.
6259.	5323.	4475.	3762.	3173.	2688.	2287.	1957.	1682.	1446.
1239.	1053.	897.	837.	781.	729.	680.	634.	592.	552.
515.	481.	448.	418.	390.	364.	340.	317.	296.	276.
258.	240.	224.	209.	195.	182.	170.	159.	148.	138.
129.	120.	112.	105.	98.	91.	85.	79.	74.	69.

64.	60.	56.	52.	49.	46.	42.	40.	37.	35.
32.	30.	28.	26.	24.	23.	21.	20.	18.	17.
16.	15.	14.	13.	12.	11.	11.	10.	9.	9.
8.	8.	7.	7.	6.	6.	5.	5.	5.	4.
4.	4.	4.	3.	3.	3.	3.	2.	2.	2.
2.	2.	2.	2.	2.	1.	1.	1.	1.	1.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	9032.	6816.	2579.	899.	129509.
CMS	256.	193.	73.	25.	3667.
INCHES		9.91	14.99	15.69	15.69
MM		251.72	380.84	398.42	398.44
AC-FT		3381.	5115.	5351.	5352.
THOUS CU M		4170.	6310.	6601.	6601.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 5

10.	9.	8.	8.	7.	7.	6.	6.	5.	5.
5.	5.	10.	31.	73.	135.	212.	296.	376.	444.
459.	545.	583.	614.	683.	863.	1204.	1728.	2423.	3247.
4137.	5250.	6681.	8219.	9639.	10672.	11116.	10831.	9969.	8872.
7703.	6551.	5508.	4630.	3905.	3308.	2815.	2409.	2070.	1780.
1525.	1296.	1104.	1030.	961.	897.	837.	781.	728.	680.
634.	592.	552.	515.	480.	448.	418.	390.	364.	340.
317.	296.	276.	257.	240.	224.	209.	195.	182.	170.
159.	148.	138.	129.	120.	112.	105.	98.	91.	85.
79.	74.	69.	64.	60.	56.	52.	49.	46.	42.
40.	37.	34.	32.	30.	28.	26.	24.	23.	21.
20.	18.	17.	16.	15.	14.	13.	12.	11.	11.
10.	9.	9.	8.	8.	7.	7.	6.	6.	5.
5.	5.	4.	4.	4.	4.	3.	3.	3.	3.
2.	2.	2.	2.	2.	2.	2.	2.	1.	1.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	11116.	8392.	3174.	1107.	159396.
CMS	315.	238.	90.	31.	4514.
INCHES		12.20	18.45	19.31	19.31
MM		309.81	468.73	490.37	490.39
AC-FT		4161.	6296.	6586.	6587.
THOUS CU M		5133.	7766.	8124.	8124.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 6

12.	11.	10.	10.	9.	8.	8.	7.	7.	6.
6.	6.	13.	39.	91.	168.	265.	371.	470.	554.
624.	681.	729.	708.	854.	1079.	1505.	2161.	3029.	4059.
5171.	6563.	8351.	10274.	12048.	13340.	13895.	13539.	12461.	11090.
9629.	8189.	6885.	5787.	4881.	4135.	3519.	3011.	2588.	2225.
1908.	1621.	1380.	1207.	1201.	1121.	1046.	976.	910.	849.
793.	739.	690.	644.	601.	560.	523.	488.	455.	425.
396.	370.	345.	322.	300.	280.	261.	244.	228.	212.
198.	185.	172.	161.	150.	140.	131.	122.	114.	106.
99.	92.	86.	80.	75.	70.	65.	61.	57.	53.
50.	46.	43.	40.	38.	35.	33.	30.	28.	27.
25.	23.	22.	20.	19.	18.	16.	15.	14.	13.
12.	12.	11.	10.	9.	9.	8.	8.	7.	7.
6.	6.	5.	5.	5.	4.	4.	4.	4.	3.
3.	3.	3.	3.	2.	2.	2.	2.	2.	2.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	13695.	10490.	3906.	1304.	199245.
CMS	393.	297.	112.	39.	5642.
INCHES		15.25	23.07	24.13	24.13
MM		387.27	585.91	612.96	612.99
AC-FT		5202.	7870.	8233.	8233.
THOUS CU M		6416.	9707.	10155.	10156.

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HYDROGRAPH ROUTING

ROUTING OF INFLOW HYDROGRAPH

ISTAW	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

LOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

STORAGE	0.00	40.00	100.00	250.00	400.00	552.00	650.00	755.00	1045.00	1195.00
	1345.00	1510.00	1625.00							
OUTFLOW	0.00	30.40	45.40	61.30	73.90	285.00	383.00	400.00	421.00	2931.00
	6441.00	16750.00	22456.00							

STATION 2, PLAN 1, RTIO 1

OUTFLOW

2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	3.	3.	5.	6.	9.	12.
15.	19.	22.	26.	30.	32.	34.	37.	41.	46.
50.	56.	62.	66.	72.	215.	355.	394.	404.	410.
415.	419.	625.	955.	1012.	956.	858.	753.	654.	565.
487.	421.	421.	420.	420.	419.	418.	418.	417.	416.
416.	415.	414.	413.	412.	411.	411.	410.	409.	408.
407.	406.	405.	404.	403.	402.	401.	399.	397.	395.
392.	390.	387.	385.	381.	367.	353.	340.	327.	315.
303.	292.	275.	251.	230.	211.	193.	176.	162.	148.
135.	124.	114.	104.	95.	87.	80.	74.	74.	74.
73.	73.	73.	73.	73.	73.	72.	72.	72.	72.
72.	71.	71.	71.	71.	71.	71.	70.	70.	70.
70.	70.	70.	69.	69.	69.	69.	69.	69.	68.
68.	68.	68.	68.	68.	67.	67.	67.	67.	67.

STOR

3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
3.	3.	3.	3.	3.	4.	6.	8.	12.	15.
20.	24.	29.	35.	40.	47.	56.	70.	90.	117.
153.	200.	259.	333.	422.	521.	622.	720.	811.	892.
960.	1016.	1067.	1077.	1080.	1077.	1071.	1065.	1059.	1054.
1049.	1045.	1040.	1035.	1026.	1019.	1010.	1001.	992.	982.
972.	961.	949.	938.	926.	914.	901.	888.	875.	862.
849.	835.	821.	807.	793.	779.	765.	750.	736.	721.

707.	692.	678.	663.	648.	634.	620.	607.	594.	582.
570.	559.	548.	537.	528.	520.	512.	505.	498.	492.
487.	482.	477.	473.	469.	466.	463.	460.	457.	454.
451.	449.	446.	443.	440.	437.	434.	431.	429.	426.
423.	420.	417.	414.	411.	409.	406.	403.	400.	397.
394.	391.	389.	386.	383.	380.	377.	375.	372.	369.
366.	363.	361.	358.	355.	352.	349.	347.	344.	341.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1012.	677.	474.	220.	31668.
CMS	29.	19.	13.	6.	897.
INCHES		0.98	2.75	3.63	3.84
MM		25.00	69.95	97.39	97.43
AC-FT		336.	939.	1308.	1309.
THOUS CU M		414.	1159.	1614.	1614.

MAXIMUM STORAGE = 1080.

STATION 2, PLAN 1, RTIO 2

OUTFLOW

4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
4.	4.	4.	4.	5.	6.	8.	11.	15.	20.
26.	31.	33.	35.	37.	40.	44.	47.	51.	57.
63.	68.	76.	320.	397.	411.	866.	2868.	4293.	4145.
3697.	3197.	2802.	2502.	2176.	1868.	1597.	1363.	1166.	1000.
658.	734.	527.	545.	489.	446.	421.	421.	420.	420.
420.	419.	419.	418.	418.	417.	416.	416.	415.	414.
413.	412.	412.	411.	410.	409.	408.	407.	406.	405.
404.	403.	402.	401.	400.	398.	395.	393.	391.	388.
386.	383.	372.	358.	344.	331.	319.	307.	295.	283.
259.	237.	217.	199.	182.	167.	153.	140.	128.	117.
108.	99.	90.	83.	76.	74.	74.	73.	73.	73.
73.	73.	73.	72.	72.	72.	72.	72.	72.	71.
71.	71.	71.	71.	71.	70.	70.	70.	70.	70.
70.	69.	69.	69.	69.	69.	69.	68.	68.	68.

STOR

5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
5.	5.	5.	5.	6.	8.	10.	15.	20.	27.
34.	43.	52.	61.	71.	84.	101.	125.	161.	210.

274.	356.	461.	567.	734.	901.	1072.	1192.	1232.	1228.
1216.	1202.	1187.	1169.	1150.	1132.	1115.	1101.	1090.	1080.
1071.	1064.	1057.	1052.	1049.	1047.	1044.	1041.	1038.	1033.
1028.	1021.	1014.	1007.	998.	990.	980.	970.	960.	949.
936.	927.	915.	903.	890.	877.	864.	851.	838.	824.
811.	797.	783.	768.	754.	740.	725.	711.	696.	682.
667.	653.	639.	625.	611.	598.	586.	574.	562.	551.
541.	531.	522.	514.	507.	500.	494.	489.	484.	479.
475.	471.	467.	464.	461.	458.	455.	452.	450.	447.
444.	441.	438.	435.	433.	430.	427.	424.	421.	418.
415.	413.	410.	407.	404.	401.	398.	396.	393.	390.
387.	384.	381.	379.	376.	373.	370.	367.	365.	362.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4293.	2029.	1017.	424.	61114.
CMS	122.	74.	29.	12.	1731.
INCHES		3.82	5.91	7.40	7.40
MM		97.05	150.20	187.96	188.02
AC-FT		1303.	2017.	2525.	2525.
THOUS CU M		1608.	2486.	3114.	3115.

MAXIMUM STORAGE = 1232.

STATION 2, PLAN 1, RTIO 3

OUTFLOW

6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
6.	5.	5.	6.	6.	8.	11.	16.	22.	29.
32.	35.	38.	41.	44.	47.	50.	54.	59.	65.
70.	193.	384.	405.	421.	3805.	6397.	6795.	6540.	5977.
5289.	4569.	3878.	3265.	2823.	2531.	2213.	1915.	1650.	1420.
1221.	1047.	894.	777.	698.	637.	588.	546.	508.	473.
441.	421.	421.	420.	420.	420.	419.	419.	418.	418.
417.	416.	416.	415.	414.	413.	413.	412.	411.	410.
409.	408.	407.	406.	405.	404.	403.	402.	401.	400.
398.	395.	393.	391.	388.	386.	384.	373.	359.	346.
333.	320.	308.	297.	286.	262.	240.	220.	201.	184.
169.	154.	141.	130.	119.	109.	100.	91.	84.	77.
74.	74.	73.	73.	73.	73.	73.	73.	72.	72.
72.	72.	72.	72.	71.	71.	71.	71.	71.	71.
70.	70.	70.	70.	70.	70.	69.	69.	69.	69.

STOR

6.	8.	8.	8.	8.	6.	8.	8.	7.	7.
7.	7.	7.	7.	9.	11.	15.	21.	29.	38.
49.	61.	74.	88.	103.	121.	146.	182.	233.	304.
396.	512.	654.	830.	1044.	1219.	1289.	1300.	1293.	1278.
1259.	1240.	1221.	1204.	1189.	1171.	1152.	1134.	1118.	1105.
1093.	1082.	1073.	1066.	1062.	1058.	1055.	1052.	1050.	1048.
1046.	1044.	1042.	1038.	1033.	1028.	1022.	1015.	1008.	999.
991.	981.	971.	961.	950.	939.	928.	916.	904.	892.
879.	866.	853.	839.	826.	812.	798.	784.	770.	756.
741.	727.	713.	698.	684.	669.	655.	640.	626.	613.
600.	587.	575.	564.	553.	542.	532.	523.	515.	508.
501.	495.	489.	484.	480.	475.	471.	468.	464.	461.
458.	456.	453.	450.	447.	444.	442.	439.	436.	433.
430.	427.	424.	422.	419.	416.	413.	410.	407.	404.
402.	399.	396.	393.	390.	387.	385.	382.	379.	376.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6795.	4432.	1564.	630.	90710.
CMS	192.	126.	45.	18.	2569.
INCHES		6.44	9.21	10.98	10.99
MM		163.63	233.97	278.98	279.07
AC-FT		2198.	3143.	3747.	3748.
THOUS CU M		2711.	3876.	4622.	4624.

MAXIMUM STORAGE = 1300.

STATION 2, PLAN 1, RTIO 4

OUTFLOW

8.	8.	8.	8.	6.	8.	8.	7.	7.	7.
7.	7.	7.	7.	8.	11.	15.	21.	29.	33.
36.	39.	43.	46.	49.	51.	55.	60.	65.	70.
204.	385.	407.	546.	4960.	7300.	8756.	8919.	8441.	7762.
6875.	5939.	5042.	4245.	3574.	3016.	2710.	2408.	2106.	1827.
1576.	1356.	1160.	1010.	906.	828.	765.	709.	660.	615.
573.	531.	499.	465.	434.	421.	421.	420.	420.	420.
419.	419.	418.	418.	417.	416.	416.	415.	414.	413.
412.	411.	411.	410.	409.	408.	407.	406.	405.	404.
403.	402.	401.	400.	397.	395.	393.	390.	388.	386.

383.	370.	356.	343.	330.	318.	306.	294.	281.	257.
235.	215.	197.	181.	165.	151.	139.	127.	116.	107.
98.	90.	82.	75.	74.	74.	73.	73.	73.	73.
73.	73.	72.	72.	72.	72.	72.	72.	71.	71.
71.	71.	71.	71.	70.	70.	70.	70.	70.	70.

STOR

10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
9.	9.	9.	10.	11.	14.	19.	27.	38.	50.
64.	80.	98.	116.	136.	160.	192.	239.	306.	399.
517.	682.	846.	1070.	1250.	1328.	1351.	1354.	1345.	1327.
1302.	1277.	1252.	1231.	1213.	1197.	1182.	1164.	1146.	1129.
1114.	1101.	1089.	1080.	1074.	1069.	1066.	1062.	1059.	1057.
1054.	1052.	1050.	1048.	1046.	1044.	1041.	1037.	1032.	1027.
1021.	1013.	1006.	997.	989.	979.	969.	959.	948.	937.
925.	914.	901.	889.	876.	863.	850.	837.	823.	809.
795.	781.	767.	753.	738.	724.	709.	695.	681.	666.
652.	637.	623.	610.	597.	585.	573.	561.	550.	540.
530.	522.	514.	506.	500.	494.	488.	483.	479.	474.
470.	467.	464.	461.	458.	455.	452.	449.	447.	444.
441.	438.	435.	432.	430.	427.	424.	421.	418.	415.
412.	410.	407.	404.	401.	398.	395.	392.	390.	387.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	8919.	6167.	2167.	836.	120396.
CMS	253.	175.	61.	24.	3409.
INCHES		8.99	12.60	14.58	14.58
MM		228.42	319.95	370.28	370.40
AC-FT		3068.	4297.	4973.	4975.
THOUS CU M		3784.	5301.	6135.	6137.

MAXIMUM STORAGE = 1354.

STATION 2, PLAN 1, RTIO 5

OUTFLOW

10.	10.	10.	9.	9.	9.	9.	9.	9.	9.
9.	9.	9.	9.	10.	13.	18.	26.	32.	35.
39.	44.	47.	49.	52.	56.	60.	64.	69.	148.
387.	404.	421.	4712.	8351.	10175.	10908.	10975.	10389.	9401.
8292.	7287.	6262.	5224.	4399.	3715.	3151.	2785.	2505.	2207.

1922.	1659.	1423.	1240.	1114.	1019.	941.	873.	812.	756.
705.	658.	614.	572.	534.	498.	465.	434.	421.	421.
420.	420.	420.	419.	419.	418.	418.	417.	416.	416.
415.	414.	413.	412.	411.	411.	410.	409.	408.	407.
405.	405.	404.	403.	402.	401.	400.	397.	395.	393.
390.	388.	386.	383.	370.	356.	343.	330.	318.	306.
294.	281.	257.	235.	215.	197.	181.	165.	151.	139.
127.	116.	107.	96.	90.	82.	75.	74.	74.	73.
73.	73.	73.	73.	73.	72.	72.	72.	72.	72.
72.	71.	71.	71.	71.	71.	71.	70.	70.	70.

STOR

13.	13.	13.	12.	12.	12.	12.	12.	12.	12.
12.	11.	11.	12.	14.	17.	24.	34.	46.	62.
80.	100.	121.	144.	169.	198.	239.	297.	380.	492.
634.	812.	1042.	1243.	1343.	1379.	1394.	1395.	1384.	1364.
1341.	1314.	1284.	1257.	1235.	1216.	1201.	1186.	1170.	1152.
1135.	1119.	1105.	1094.	1086.	1081.	1076.	1072.	1068.	1065.
1062.	1059.	1057.	1054.	1052.	1050.	1048.	1046.	1044.	1041.
1037.	1032.	1027.	1020.	1013.	1006.	997.	989.	979.	969.
959.	948.	937.	925.	913.	901.	889.	876.	863.	850.
836.	823.	809.	795.	781.	767.	753.	738.	724.	709.
695.	680.	666.	651.	637.	623.	610.	597.	585.	573.
561.	550.	540.	530.	522.	514.	506.	500.	494.	488.
483.	479.	474.	470.	467.	464.	461.	458.	455.	452.
449.	447.	444.	441.	438.	435.	432.	430.	427.	424.
421.	418.	415.	412.	410.	407.	404.	401.	398.	395.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	10975.	7985.	2758.	1042.	150134.
CMS	311.	226.	78.	30.	4251.
INCHES		11.61	16.03	18.18	18.18
MM		294.79	407.21	461.75	461.69
AC-FT		3959.	5469.	6202.	6204.
THOUS CU M		4884.	6746.	7650.	7652.

MAXIMUM STORAGE = . 1395.

STATION 2, PLAN 1, RTIO 6

OUTFLOW

12.	12.	12.	12.	12.	12.	12.	11.	11.	11.
11.	11.	11.	11.	13.	17.	23.	31.	34.	39.
44.	47.	50.	54.	57.	61.	64.	69.	113.	347.
402.	419.	4153.	6035.	11211.	12724.	13635.	13719.	12986.	11752.
10332.	8680.	7554.	6517.	5496.	4644.	3939.	3357.	2898.	2645.
2348.	2047.	1766.	1544.	1390.	1272.	1175.	1091.	1015.	945.
881.	822.	767.	715.	668.	623.	581.	542.	506.	472.
440.	421.	421.	420.	420.	420.	419.	419.	418.	418.
417.	416.	416.	415.	414.	413.	413.	412.	411.	410.
409.	408.	407.	406.	405.	404.	403.	402.	401.	400.
396.	395.	393.	391.	388.	386.	384.	373.	359.	346.
333.	320.	308.	297.	286.	262.	240.	220.	201.	184.
169.	154.	141.	130.	119.	109.	100.	91.	84.	77.
74.	74.	73.	73.	73.	73.	73.	73.	72.	72.
72.	72.	72.	72.	71.	71.	71.	71.	71.	71.

STOR

16.	15.	16.	16.	15.	15.	15.	15.	15.	15.
14.	14.	14.	15.	17.	22.	30.	42.	58.	76.
100.	125.	153.	181.	212.	250.	301.	374.	477.	614.
789.	1015.	1228.	1349.	1400.	1430.	1448.	1450.	1435.	1411.
1383.	1354.	1324.	1293.	1265.	1242.	1222.	1207.	1193.	1178.
1160.	1142.	1125.	1112.	1103.	1096.	1090.	1085.	1080.	1076.
1073.	1069.	1066.	1063.	1060.	1057.	1055.	1052.	1050.	1048.
1046.	1044.	1042.	1036.	1033.	1028.	1022.	1015.	1008.	999.
991.	981.	971.	961.	950.	939.	928.	916.	904.	892.
879.	866.	853.	839.	826.	812.	798.	784.	770.	756.
741.	727.	713.	698.	684.	669.	655.	640.	626.	613.
600.	587.	575.	564.	553.	542.	532.	523.	515.	508.
501.	495.	489.	484.	480.	475.	471.	468.	464.	461.
456.	456.	453.	450.	447.	444.	442.	439.	436.	433.
430.	427.	424.	422.	419.	416.	413.	410.	407.	404.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	13719.	10239.	3554.	1318.	189838.
CMS	388.	290.	101.	37.	5376.
INCHES		14.88	20.66	22.99	22.99
MM		378.02	524.77	583.86	584.05
AC-FT		5077.	7048.	7842.	7845.
THOUS CU M		6263.	8694.	9673.	9676.

MAXIMUM STORAGE = 1450.

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SUB-AREA RUNOFF COMPUTATION

CALCULATION OF INFLOW HYDROGRAPH SUBAREA 2

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	12.60	0.00	12.60	0.00	0.000	0	0	0

PRECIP DATA

SPFE	PAS	R6	R12	R24	R48	R72	R96
0.00	22.50	114.00	124.00	137.00	0.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.808

LOSS DATA

LOSS1	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.10	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 4.68 CP=0.63 NTA= 0

RECESSION DATA

STRTQ= -2.00 QRCSN= -0.10 RTIOR= 2.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC=10.53 AND R= 8.42 INTERVALS

UNIT HYDROGRAPH 51 END-OF-PERIOD ORDINATES, LAG= 4.64 HOURS, CP= 0.63 VOL= 1.00

38.	140.	263.	446.	621.	796.	946.	1053.	1114.	1126.
1072.	966.	858.	762.	676.	600.	533.	473.	420.	373.
331.	294.	261.	232.	206.	183.	162.	144.	128.	114.
101.	90.	80.	71.	63.	56.	49.	44.	39.	35.
31.	27.	24.	21.	19.	17.	15.	13.	12.	11.
9.									

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	0.30	1	0.08	0.00	0.08	24.	1.02	14.00	76	0.00	0.00	0.00	804.
1.01	1.00	2	0.08	0.00	0.08	22.	1.02	14.30	77	0.00	0.00	0.00	750.
1.01	1.30	3	0.08	0.00	0.08	20.	1.02	15.00	78	0.00	0.00	0.00	700.
1.01	2.00	4	0.08	0.00	0.08	19.	1.02	15.30	79	0.00	0.00	0.00	653.
1.01	2.30	5	0.08	0.00	0.08	18.	1.02	16.00	80	0.00	0.00	0.00	609.
1.01	3.00	6	0.08	0.00	0.08	17.	1.02	16.30	81	0.00	0.00	0.00	568.
1.01	3.30	7	0.08	0.00	0.08	16.	1.02	17.00	82	0.00	0.00	0.00	530.
1.01	4.00	8	0.08	0.00	0.08	14.	1.02	17.30	83	0.00	0.00	0.00	495.
1.01	4.30	9	0.08	0.00	0.08	14.	1.02	18.00	84	0.00	0.00	0.00	462.
1.01	5.00	10	0.08	0.00	0.08	13.	1.02	18.30	85	0.00	0.00	0.00	431.
1.01	5.30	11	0.08	0.00	0.08	12.	1.02	19.00	86	0.00	0.00	0.00	402.
1.01	6.00	12	0.08	0.00	0.08	11.	1.02	19.30	87	0.00	0.00	0.00	375.
1.01	6.30	13	0.15	0.08	0.09	13.	1.02	20.00	88	0.00	0.00	0.00	350.
1.01	7.00	14	0.15	0.10	0.05	22.	1.02	20.30	89	0.00	0.00	0.00	326.
1.01	7.30	15	0.15	0.10	0.05	45.	1.02	21.00	90	0.00	0.00	0.00	305.
1.01	8.00	16	0.15	0.10	0.05	84.	1.02	21.30	91	0.00	0.00	0.00	284.
1.01	8.30	17	0.15	0.10	0.05	140.	1.02	22.00	92	0.00	0.00	0.00	265.

1.01	9.00	18	0.13	0.10	0.05	214.	1.02	22.30	93	0.00	0.00	0.00	247.
1.01	9.30	19	0.13	0.10	0.05	304.	1.02	23.00	94	0.00	0.00	0.00	231.
1.01	10.00	20	0.13	0.10	0.05	407.	1.02	23.30	95	0.00	0.00	0.00	215.
1.01	10.30	21	0.13	0.10	0.05	517.	1.03	0.00	96	0.00	0.00	0.00	201.
1.01	11.00	22	0.13	0.10	0.05	631.	1.03	0.30	97	0.00	0.00	0.00	187.
1.01	11.30	23	0.13	0.10	0.05	741.	1.03	1.00	98	0.00	0.00	0.00	175.
1.01	12.00	24	0.13	0.10	0.05	843.	1.03	1.30	99	0.00	0.00	0.00	163.
1.01	12.30	25	1.04	0.99	0.05	967.	1.03	2.00	100	0.00	0.00	0.00	152.
1.01	13.00	26	1.04	0.99	0.05	1171.	1.03	2.30	101	0.00	0.00	0.00	142.
1.01	13.30	27	1.24	1.19	0.05	1500.	1.03	3.00	102	0.00	0.00	0.00	133.
1.01	14.00	28	1.24	1.19	0.05	1987.	1.03	3.30	103	0.00	0.00	0.00	124.
1.01	14.30	29	1.55	1.50	0.05	2664.	1.03	4.00	104	0.00	0.00	0.00	115.
1.01	15.00	30	1.55	1.50	0.05	3555.	1.03	4.30	105	0.00	0.00	0.00	108.
1.01	15.30	31	1.89	1.84	0.05	4667.	1.03	5.00	106	0.00	0.00	0.00	100.
1.01	16.00	32	1.89	1.84	0.05	6144.	1.03	5.30	107	0.00	0.00	0.00	94.
1.01	16.30	33	1.45	1.40	0.05	8051.	1.03	6.00	108	0.00	0.00	0.00	87.
1.01	17.00	34	1.45	1.40	0.05	10217.	1.03	6.30	109	0.00	0.00	0.00	82.
1.01	17.30	35	1.14	1.09	0.05	12459.	1.03	7.00	110	0.00	0.00	0.00	76.
1.01	18.00	36	1.14	1.09	0.05	14647.	1.03	7.30	111	0.00	0.00	0.00	71.
1.01	18.30	37	0.12	0.07	0.05	16636.	1.03	8.00	112	0.00	0.00	0.00	66.
1.01	19.00	38	0.12	0.07	0.05	18215.	1.03	8.30	113	0.00	0.00	0.00	62.
1.01	19.30	39	0.12	0.07	0.05	19250.	1.03	9.00	114	0.00	0.00	0.00	58.
1.01	20.00	40	0.12	0.07	0.05	19715.	1.03	9.30	115	0.00	0.00	0.00	54.
1.01	20.30	41	0.12	0.07	0.05	19599.	1.03	10.00	116	0.00	0.00	0.00	50.
1.01	21.00	42	0.12	0.07	0.05	18854.	1.03	10.30	117	0.00	0.00	0.00	47.
1.01	21.30	43	0.12	0.07	0.05	17529.	1.03	11.00	118	0.00	0.00	0.00	44.
1.01	22.00	44	0.12	0.07	0.05	16214.	1.03	11.30	119	0.00	0.00	0.00	41.
1.01	22.30	45	0.12	0.07	0.05	14753.	1.03	12.00	120	0.00	0.00	0.00	38.
1.01	23.00	46	0.12	0.07	0.05	13311.	1.03	12.30	121	0.00	0.00	0.00	36.
1.01	23.30	47	0.12	0.07	0.05	11956.	1.03	13.00	122	0.00	0.00	0.00	33.
1.02	0.00	48	0.12	0.07	0.05	10742.	1.03	13.30	123	0.00	0.00	0.00	31.
1.02	0.30	49	0.00	0.00	0.00	9659.	1.03	14.00	124	0.00	0.00	0.00	29.
1.02	1.00	50	0.00	0.00	0.00	8690.	1.03	14.30	125	0.00	0.00	0.00	27.
1.02	1.30	51	0.00	0.00	0.00	7820.	1.03	15.00	126	0.00	0.00	0.00	25.
1.02	2.00	52	0.00	0.00	0.00	7033.	1.03	15.30	127	0.00	0.00	0.00	23.
1.02	2.30	53	0.00	0.00	0.00	6319.	1.03	16.00	128	0.00	0.00	0.00	22.
1.02	3.00	54	0.00	0.00	0.00	5669.	1.03	16.30	129	0.00	0.00	0.00	20.
1.02	3.30	55	0.00	0.00	0.00	5075.	1.03	17.00	130	0.00	0.00	0.00	19.
1.02	4.00	56	0.00	0.00	0.00	4534.	1.03	17.30	131	0.00	0.00	0.00	18.
1.02	4.30	57	0.00	0.00	0.00	4041.	1.03	18.00	132	0.00	0.00	0.00	17.
1.02	5.00	58	0.00	0.00	0.00	3593.	1.03	18.30	133	0.00	0.00	0.00	15.
1.02	5.30	59	0.00	0.00	0.00	3192.	1.03	19.00	134	0.00	0.00	0.00	14.
1.02	6.00	60	0.00	0.00	0.00	2834.	1.03	19.30	135	0.00	0.00	0.00	13.
1.02	6.30	61	0.00	0.00	0.00	2516.	1.03	20.00	136	0.00	0.00	0.00	13.
1.02	7.00	62	0.00	0.00	0.00	2234.	1.03	20.30	137	0.00	0.00	0.00	12.
1.02	7.30	63	0.00	0.00	0.00	1983.	1.03	21.00	138	0.00	0.00	0.00	11.
1.02	8.00	64	0.00	0.00	0.00	1847.	1.03	21.30	139	0.00	0.00	0.00	10.
1.02	8.30	65	0.00	0.00	0.00	1723.	1.03	22.00	140	0.00	0.00	0.00	10.
1.02	9.00	66	0.00	0.00	0.00	1606.	1.03	22.30	141	0.00	0.00	0.00	9.
1.02	9.30	67	0.00	0.00	0.00	1500.	1.03	23.00	142	0.00	0.00	0.00	8.
1.02	10.00	68	0.00	0.00	0.00	1399.	1.03	23.30	143	0.00	0.00	0.00	8.
1.02	10.30	69	0.00	0.00	0.00	1306.	1.04	0.00	144	0.00	0.00	0.00	7.
1.02	11.00	70	0.00	0.00	0.00	1216.	1.04	0.30	145	0.00	0.00	0.00	7.
1.02	11.30	71	0.00	0.00	0.00	1137.	1.04	1.00	146	0.00	0.00	0.00	6.
1.02	12.00	72	0.00	0.00	0.00	1061.	1.04	1.30	147	0.00	0.00	0.00	6.
1.02	12.30	73	0.00	0.00	0.00	990.	1.04	2.00	148	0.00	0.00	0.00	5.
1.02	13.00	74	0.00	0.00	0.00	923.	1.04	2.30	149	0.00	0.00	0.00	5.
1.02	13.30	75	0.00	0.00	0.00	861.	1.04	3.00	150	0.00	0.00	0.00	5.

SUM 24.91 22.12 2.78 371766.
(033.)(562.)(71.)(10527.24)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	19710.	16752.	7352.	2531.	371748.
CMS	556.	474.	208.	73.	10527.
INCHES		12.37	21.71	22.87	22.87
MM		314.15	551.46	580.88	580.93
AC-FT		8307.	14583.	15300.	15361.
THOUS CU M		10246.	17988.	18947.	18948.

HYDROGRAPH AT STA 2 FOR PLAN 1, RTIO 1

5.	4.	4.	4.	3.	3.	3.	3.	3.
2.	2.	3.	4.	9.	17.	28.	43.	61.	81.
103.	126.	148.	169.	193.	234.	300.	397.	533.	711.
933.	1229.	1610.	2043.	2492.	2929.	3327.	3643.	3850.	3943.
3920.	3771.	3526.	3243.	2951.	2662.	2392.	2148.	1932.	1738.
1564.	1407.	1264.	1134.	1015.	907.	808.	719.	638.	567.
503.	447.	397.	369.	345.	322.	300.	280.	261.	244.
227.	212.	198.	185.	172.	161.	150.	140.	131.	122.
114.	106.	99.	92.	86.	80.	75.	70.	65.	61.
57.	53.	49.	46.	43.	40.	37.	35.	33.	30.
28.	27.	25.	23.	22.	20.	19.	17.	16.	15.
14.	13.	12.	12.	11.	10.	9.	9.	8.	8.
7.	7.	6.	6.	5.	5.	5.	4.	4.	4.
4.	3.	3.	3.	3.	3.	2.	2.	2.	2.
2.	2.	2.	1.	1.	1.	1.	1.	1.	1.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3943.	3350.	1470.	516.	74350.
CMS	112.	95.	42.	15.	2105.
INCHES		2.47	4.34	4.57	4.57
MM		62.93	110.30	116.18	116.19
AC-FT		1661.	2917.	3072.	3072.
THOUS CU M		2049.	3598.	3789.	3790.

HYDROGRAPH AT STA 2 FOR PLAN 1, RTIO 2

8.	8.	7.	7.	6.	6.	5.	5.	5.	4.
4.	4.	4.	5.	16.	29.	49.	75.	106.	142.
181.	221.	259.	295.	338.	410.	525.	696.	932.	1244.
1634.	2150.	2816.	3570.	4361.	5126.	5822.	6375.	6737.	6900.
6860.	6599.	6176.	5675.	5104.	4659.	4185.	3700.	3381.	3042.
2737.	2462.	2212.	1984.	1776.	1587.	1414.	1258.	1117.	992.
881.	782.	694.	616.	603.	563.	525.	490.	457.	426.
396.	371.	348.	323.	302.	281.	262.	245.	228.	213.
199.	186.	173.	162.	151.	141.	131.	122.	114.	107.
99.	93.	87.	81.	75.	70.	66.	61.	57.	53.
50.	46.	43.	40.	38.	35.	33.	31.	29.	27.
25.	23.	22.	20.	19.	18.	16.	15.	14.	13.
12.	12.	11.	10.	9.	9.	8.	8.	7.	7.
6.	6.	5.	5.	5.	4.	4.	4.	4.	3.
3.	3.	3.	3.	2.	2.	2.	2.	2.	2.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6900.	5863.	2573.	903.	130112.
CMS	195.	166.	73.	26.	3684.
INCHES		4.33	7.60	8.00	8.00
MM		109.96	193.02	203.31	203.32
AC-FT		2907.	5104.	5376.	5377.

INDUS CO A	3560.	0296.	0031.	0032.

HYDROGRAPH AT STA 2 FOR PLAN 1, RTIO 3

12.	11.	10.	10.	9.	8.	8.	7.	7.	6.
0.	5.	5.	11.	23.	42.	70.	107.	152.	203.
259.	315.	371.	421.	463.	500.	750.	994.	1332.	1778.
2334.	3072.	4020.	5106.	6230.	7323.	8318.	9107.	9625.	9857.
9769.	9427.	8814.	8107.	7377.	6656.	5979.	5371.	4829.	4345.
3910.	3517.	3160.	2835.	2538.	2267.	2020.	1797.	1596.	1417.
1258.	1117.	992.	923.	861.	804.	750.	700.	653.	609.
568.	530.	495.	462.	431.	402.	375.	350.	326.	305.
284.	265.	247.	231.	215.	201.	187.	175.	163.	152.
142.	133.	124.	115.	108.	100.	94.	87.	82.	76.
71.	66.	62.	58.	54.	50.	47.	44.	41.	38.
36.	33.	31.	29.	27.	25.	23.	22.	20.	19.
18.	17.	15.	14.	13.	13.	12.	11.	10.	10.
9.	8.	8.	7.	7.	6.	6.	5.	5.	5.
4.	4.	4.	4.	3.	3.	3.	3.	3.	2.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	9857.	8376.	3676.	1291.	185874.
CMS	279.	237.	104.	37.	5263.
INCHES		6.18	10.86	11.43	11.44
MM		157.07	275.74	290.44	290.40
AC-FT		4153.	7291.	7260.	7261.
INDUS CO A		5123.	8994.	9473.	9474.

HYDROGRAPH AT STA 2 FOR PLAN 1, RTIO 4

15.	14.	13.	12.	12.	11.	10.	9.	9.	8.
8.	7.	8.	15.	29.	55.	91.	139.	198.	264.
336.	410.	492.	586.	688.	761.	975.	1292.	1731.	2311.
3054.	3993.	5233.	6641.	8098.	9520.	10613.	11840.	12512.	12815.
12739.	12255.	11458.	10539.	9590.	8652.	7773.	6982.	6278.	5649.
5083.	4572.	4106.	3685.	3299.	2947.	2626.	2336.	2075.	1842.
1635.	1452.	1289.	1200.	1120.	1045.	975.	910.	849.	792.
739	689.	643.	600.	560.	522.	487.	455.	424.	396.
369.	345.	322.	300.	280.	261.	244.	227.	212.	198.
185.	172.	161.	150.	140.	131.	122.	114.	106.	99.
92.	86.	80.	75.	70.	65.	61.	57.	53.	49.
46.	43.	40.	38.	35.	33.	30.	28.	27.	25.
23.	22.	20.	19.	17.	16.	15.	14.	13.	12.
12.	11.	10.	9.	9.	8.	8.	7.	7.	6.
0.	5.	5.	5.	4.	4.	4.	4.	3.	3.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	12815.	10889.	4779.	1678.	241636.
CMS	363.	308.	135.	48.	6842.
INCHES		8.04	14.11	14.87	14.87
MM		204.19	358.46	377.57	377.60
AC-FT		5400.	9479.	9984.	9985.
INDUS CO A		6660.	11692.	12315.	12316.

HYDROGRAPH AT STA 2 FOR PLAN 1, RTIO 5

19.	18.	18.	17.	16.	15.	14.	13.	12.	11.
9.	9.	10.	18.	36.	67.	112.	171.	243.	325.

414.	505.	593.	674.	773.	937.	1200.	1590.	2131.	2844.
3734.	4915.	6481.	8173.	9967.	11717.	13309.	14572.	15400.	15772.
15679.	15083.	14102.	12971.	11802.	10649.	9566.	8593.	7727.	6952.
6256.	5629.	5059.	4535.	4060.	3627.	3233.	2875.	2553.	2267.
2013.	1787.	1587.	1477.	1378.	1286.	1200.	1120.	1045.	975.
909.	848.	792.	739.	689.	643.	600.	560.	522.	487.
455.	424.	396.	369.	345.	322.	300.	280.	261.	244.
227.	212.	198.	185.	172.	161.	150.	140.	131.	122.
114.	106.	99.	92.	86.	80.	75.	70.	65.	61.
57.	53.	49.	46.	43.	40.	37.	35.	33.	30.
28.	27.	25.	23.	22.	20.	19.	17.	16.	15.
14.	13.	12.	12.	11.	10.	9.	9.	8.	8.
7.	7.	6.	6.	5.	5.	5.	4.	4.	4.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	15772.	13402.	5862.	2065.	297398.
CMS	447.	379.	167.	58.	8421.
INCHES		9.89	17.37	18.30	18.30
MM		251.32	441.18	464.71	464.74
AC-FT		6646.	11666.	12288.	12289.
THOUS CU M		8197.	14390.	15157.	15158.

HYDROGRAPH AT STA 2 FOR PLAN 1, RTIO 6

24.	22.	20.	19.	18.	17.	16.	14.	14.	13.
12.	11.	13.	22.	45.	84.	140.	214.	304.	407.
517.	631.	741.	843.	967.	1171.	1500.	1987.	2664.	3555.
4667.	6144.	8051.	10217.	12459.	14647.	16636.	18215.	19250.	19715.
19559.	18854.	17628.	16214.	14753.	13311.	11958.	10742.	9659.	8690.
7820.	7033.	6319.	5669.	5075.	4534.	4041.	3593.	3192.	2834.
2516.	2234.	1983.	1847.	1723.	1608.	1500.	1399.	1306.	1218.
1137.	1061.	990.	923.	861.	804.	750.	700.	653.	609.
568.	530.	495.	462.	431.	402.	375.	350.	326.	305.
284.	265.	247.	231.	215.	201.	187.	175.	163.	152.
142.	133.	124.	115.	108.	100.	94.	87.	82.	76.
71.	66.	62.	58.	54.	50.	47.	44.	41.	38.
36.	33.	31.	29.	27.	25.	23.	22.	20.	19.
18.	17.	15.	14.	13.	13.	12.	11.	10.	10.
9.	8.	8.	7.	7.	6.	6.	5.	5.	5.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	19715.	16752.	7352.	2581.	371748.
CMS	558.	474.	208.	73.	10527.
INCHES		12.37	21.71	22.87	22.87
MM		314.15	551.48	580.88	580.93
AC-FT		8307.	14583.	15360.	15361.
THOUS CU M		10246.	17988.	18947.	18948.

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COMBINE HYDROGRAPHS

COMBINE HYDROGRAPHS SUBAREA 1 AND SUBAREA 2

ISTAG	ICOMP	ICOMB	ILAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	2	0	0	0	0	1	0	0

SUM OF 2 HYDROGRAPHS AT 2 PLAN 1 RTIO 1

7.	7.	6.	6.	6.	6.	5.	5.	5.	5.
5.	4.	5.	7.	12.	20.	33.	49.	70.	93.
116.	145.	171.	195.	224.	266.	334.	434.	574.	757.
964.	1264.	1672.	2110.	2563.	3144.	3682.	4037.	4254.	4353.
4330.	4190.	4151.	4196.	3963.	3616.	3249.	2901.	2585.	2303.
2051.	1825.	1655.	1554.	1435.	1326.	1227.	1137.	1055.	983.
919.	862.	811.	765.	757.	733.	711.	690.	670.	651.
634.	618.	603.	589.	575.	562.	551.	539.	527.	516.
506.	496.	486.	477.	468.	448.	428.	410.	393.	376.
360.	345.	321.	296.	273.	251.	230.	211.	194.	178.
164.	151.	138.	127.	117.	107.	99.	91.	90.	89.
88.	86.	85.	84.	83.	83.	82.	81.	80.	79.
79.	78.	78.	77.	76.	76.	75.	75.	74.	74.
74.	73.	73.	72.	72.	72.	71.	71.	71.	70.
70.	70.	69.	69.	69.	69.	68.	68.	68.	68.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4353.	3921.	1882.	736.	106018.
CMS	123.	111.	53.	21.	3002.
INCHES		1.92	3.69	4.32	4.33
MM		48.76	93.62	109.83	109.87
AC-FT		1944.	3733.	4360.	4381.
THOUS CU M		2398.	4605.	5402.	5404.

SUM OF 2 HYDROGRAPHS AT 2 PLAN 1 RTIO 2

12.	12.	11.	11.	10.	10.	9.	9.	9.	8.
8.	8.	8.	12.	20.	35.	57.	86.	122.	163.
207.	252.	292.	330.	376.	450.	569.	743.	984.	1301.
1696.	2218.	2694.	3096.	4757.	5537.	6689.	9263.	11030.	11045.
10556.	9796.	8972.	8177.	7339.	6527.	5782.	5123.	4547.	4041.
3594.	3196.	2838.	2529.	2265.	2033.	1835.	1678.	1538.	1412.
1306.	1201.	1113.	1065.	1021.	980.	941.	905.	872.	840.
811.	784.	758.	734.	711.	690.	670.	652.	634.	618.
603.	589.	575.	563.	551.	538.	526.	515.	505.	495.
485.	476.	458.	438.	420.	402.	385.	368.	352.	336.
309.	284.	260.	239.	220.	202.	185.	170.	157.	144.
132.	122.	112.	103.	95.	91.	90.	89.	88.	86.
85.	84.	83.	83.	82.	81.	80.	79.	79.	78.
77.	77.	76.	76.	75.	75.	74.	74.	73.	73.
73.	72.	72.	72.	71.	71.	71.	70.	70.	70.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	11045.	8370.	3538.	1328.	191225.
CMS	313.	237.	100.	38.	5415.
INCHES		4.10	6.93	7.80	7.80
MM		104.16	176.01	198.11	198.17
AC-FT		4153.	7018.	7900.	7902.
THOUS CU M		5123.	8657.	9744.	9747.

SUM OF 2 HYDROGRAPHS AT 2 PLAN 1 RTIO 3

16.	17.	16.	15.	15.	14.	14.	13.	12.	12.
11.	11.	12.	17.	29.	50.	81.	123.	174.	233.

291.	350.	409.	462.	526.	632.	800.	1047.	1391.	1842.
2404.	3265.	4409.	5514.	6650.	11129.	14715.	15903.	16165.	15835.
15056.	13996.	12592.	11372.	10199.	9186.	8192.	7286.	6480.	5766.
5131.	4563.	4054.	3612.	3235.	2904.	2609.	2342.	2103.	1890.
1699.	1536.	1412.	1344.	1262.	1224.	1169.	1119.	1071.	1027.
985.	947.	910.	877.	845.	815.	787.	762.	737.	714.
693.	673.	654.	637.	620.	605.	591.	577.	564.	552.
540.	526.	517.	506.	496.	487.	477.	461.	441.	422.
404.	387.	370.	354.	339.	312.	287.	263.	242.	222.
204.	186.	172.	158.	146.	134.	123.	113.	104.	96.
92.	90.	89.	88.	87.	86.	85.	84.	83.	82.
81.	80.	79.	79.	78.	78.	77.	76.	76.	75.
75.	74.	74.	73.	73.	73.	72.	72.	72.	71.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	16165.	12808.	5217.	1920.	276584.
CMS	458.	363.	148.	54.	7832.
INCHES		6.27	10.22	11.28	11.28
MM		159.28	259.49	286.55	286.63
AC-FT		6351.	10347.	11426.	11429.
THOUS CU M		7834.	12763.	14094.	14098.

SUM OF 2 HYDROGRAPHS AT 2 PLAN 1 RTIO 4

23.	22.	21.	20.	19.	18.	18.	17.	16.	15.
15.	14.	15.	22.	38.	65.	106.	160.	226.	297.
372.	449.	525.	594.	677.	812.	1030.	1352.	1796.	2381.
3238.	4378.	5940.	7467.	13058.	17320.	19569.	20759.	20953.	20577.
19614.	18194.	16500.	14764.	13163.	11671.	10483.	9390.	8384.	7476.
6681.	5928.	5268.	4695.	4205.	3775.	3391.	3045.	2734.	2457.
2206.	1986.	1786.	1605.	1554.	1466.	1396.	1330.	1269.	1212.
1156.	1103.	1051.	1018.	977.	939.	903.	870.	838.	809.
782.	756.	732.	710.	689.	669.	651.	633.	617.	602.
588.	574.	562.	550.	537.	526.	514.	504.	494.	485.
476.	456.	437.	418.	400.	383.	367.	351.	334.	307.
281.	258.	237.	218.	200.	184.	169.	156.	143.	131.
121.	111.	102.	94.	91.	90.	89.	87.	86.	85.
84.	83.	82.	82.	81.	80.	79.	79.	78.	77.
77.	76.	76.	75.	75.	74.	74.	73.	73.	73.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	20953.	17073.	6907.	2513.	362032.
CMS	593.	483.	196.	71.	10252.
INCHES		8.36	13.53	14.77	14.77
MM		212.31	343.59	375.07	375.18
AC-FT		8406.	13700.	14956.	14960.
THOUS CU M		10443.	16899.	18448.	18453.

SUM OF 2 HYDROGRAPHS AT 2 PLAN 1 RTIO 5

28.	27.	26.	25.	24.	23.	22.	21.	20.	19.
18.	17.	19.	27.	47.	80.	130.	197.	275.	361.
453.	545.	640.	724.	820.	992.	1260.	1654.	2200.	2992.
4101.	5519.	6902.	12665	16318.	21892.	24217.	25547.	25788.	25173.
23971.	22370.	20304.	18195.	16201.	14364.	12717.	11378.	10232.	9159.
8178.	7288.	6479.	5776.	5175.	4616.	4173.	3748.	3365.	3023.
2716.	2445.	2200.	2050.	1912.	1764.	1665.	1553.	1465.	1395.

1330.	1209.	1211.	1156.	1108.	1061.	1018.	977.	939.	903.
869.	838.	809.	782.	756.	732.	710.	689.	669.	651.
633.	617.	602.	588.	574.	562.	550.	537.	526.	514.
504.	494.	485.	476.	456.	437.	418.	400.	383.	367.
351.	334.	305.	281.	258.	237.	218.	200.	184.	169.
155.	143.	131.	121.	111.	102.	94.	91.	90.	89.
87.	86.	85.	84.	83.	82.	82.	81.	80.	79.
79.	78.	77.	77.	76.	76.	75.	75.	74.	74.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	25788.	21300.	8605.	3107.	447532.
CMS	730.	603.	244.	88.	12673.
INCHES		10.43	16.85	18.25	18.26
MM		264.88	428.03	463.65	463.78
AC-FT		10562.	17067.	18488.	18493.
THOUS CU M		13028.	21052.	22804.	22811.

SUM OF 2 HYDROGRAPHS AT 2 PLAN 1 RTIO 6

35.	34.	32.	31.	30.	28.	27.	26.	25.	24.
23.	22.	23.	34.	58.	101.	163.	245.	339.	445.
561.	679.	791.	896.	1024.	1232.	1565.	2056.	2777.	3902.
5070.	6563.	12209.	18853.	23670.	27370.	30271.	31933.	32235.	31466.
29931.	27734.	25282.	22730.	20249.	17955.	15897.	14099.	12557.	11336.
10167.	9081.	8086.	7213.	6465.	5806.	5216.	4684.	4206.	3779.
3396.	3056.	2750.	2502.	2390.	2230.	2081.	1942.	1812.	1690.
1577.	1462.	1410.	1344.	1282.	1224.	1169.	1119.	1071.	1027.
985.	947.	910.	877.	845.	815.	787.	762.	737.	714.
693.	673.	654.	637.	620.	605.	591.	577.	564.	552.
540.	528.	517.	506.	496.	487.	477.	461.	441.	422.
404.	387.	370.	354.	339.	312.	287.	263.	242.	222.
204.	187.	172.	158.	146.	134.	123.	113.	104.	96.
92.	90.	89.	88.	87.	86.	85.	84.	83.	82.
81.	80.	79.	79.	78.	78.	77.	76.	76.	75.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	32235.	26773.	10877.	3899.	561586.
CMS	913.	758.	308.	110.	15902.
INCHES		13.11	21.30	22.91	22.91
MM		332.94	541.04	581.81	581.98
AC-FT		13270.	21574.	23199.	23206.
THOUS CU M		16376.	26611.	28616.	28624.

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HYDROGRAPH ROUTING

ROUTING OF INFLOW HYDROGRAPH

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	1	0	0	0	0	1	0	0

ROUTING DATA

JBOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

STORAGE	0.00	200.00	500.00	1050.00	1575.00	2285.00	2650.00	3040.00	3430.00	3775.00
	3975.00									
OUTFLOW	0.00	332.00	652.00	684.00	714.00	740.00	4181.00	12285.00	22408.00	31962.00
	37845.00									

STATION 3, PLAN 1, RTIO 1

OUTFLOW

7.	7.	7.	7.	7.	7.	7.	7.	7.	6.
6.	6.	6.	6.	6.	7.	8.	10.	14.	18.
24.	31.	39.	49.	60.	72.	87.	107.	133.	168.
215.	276.	344.	594.	457.	535.	629.	659.	670.	680.
690.	693.	706.	714.	719.	724.	728.	732.	735.	737.
739.	1015.	1256.	1375.	1414.	1403.	1362.	1303.	1235.	1165.
1095.	1026.	906.	911.	865.	826.	792.	762.	740.	740.
740.	740.	739.	739.	739.	739.	738.	738.	738.	737.
737.	737.	736.	736.	736.	735.	735.	734.	734.	733.
733.	732.	731.	731.	730.	729.	729.	728.	727.	726.
725.	725.	724.	723.	722.	721.	720.	719.	718.	717.
716.	715.	714.	713.	712.	710.	709.	707.	706.	704.
703.	701.	700.	698.	697.	695.	694.	693.	691.	690.
688.	687.	685.	684.	682.	680.	676.	677.	675.	673.
671.	670.	666.	666.	664.	663.	661.	659.	657.	656.

STOR

4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
4.	4.	4.	4.	4.	4.	5.	6.	8.	11.
14.	19.	24.	29.	36.	43.	52.	64.	80.	101.
130.	165.	215.	277.	356.	454.	571.	704.	848.	997.
1149.	1295.	1439.	1583.	1722.	1848.	1960.	2057.	2140.	2211.
2270.	2314.	2340.	2352.	2356.	2355.	2351.	2345.	2338.	2330.
2323.	2316.	2309.	2303.	2296.	2294.	2290.	2287.	2284.	2281.
2277.	2272.	2267.	2261.	2255.	2248.	2240.	2232.	2224.	2215.
2205.	2196.	2185.	2175.	2164.	2153.	2140.	2127.	2114.	2099.
2064.	2086.	2052.	2035.	2016.	1997.	1977.	1956.	1934.	1912.
1689.	1665.	1641.	1617.	1792.	1767.	1741.	1716.	1690.	1664.
1636.	1612.	1586.	1560.	1534.	1508.	1482.	1455.	1430.	1404.
1379.	1353.	1327.	1301.	1276.	1250.	1224.	1199.	1173.	1148.
1123.	1097.	1072.	1047.	1021.	996.	971.	946.	921.	896.
871.	846.	822.	797.	772.	748.	723.	699.	674.	650.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1414.	1214.	856.	627.	90390.
CMS	40.	34.	25.	18.	2560.
INCHES		0.59	1.70	3.69	3.69
MM		15.09	43.10	93.64	93.67
AC-FT		602.	1719.	3734.	3735.
THOUS CU M		742.	2120.	4605.	4607.

MAXIMUM STORAGE = 2356.

STATION 3, PLAN 1, RTIO 2

OUTFLOW

12.	12.	12.	12.	12.	12.	12.	12.	11.	11.
11.	11.	11.	11.	11.	12.	14.	18.	24.	32.
42.	54.	69.	85.	103.	123.	149.	182.	228.	288.
350.	402.	472.	567.	655.	669.	684.	702.	720.	736.
3149.	6501.	8233.	8438.	8029.	7371.	6640.	5927.	5271.	4684.
4172.	3918.	3625.	3318.	3017.	2734.	2473.	2240.	2034.	1851.
1690.	1547.	1420.	1312.	1224.	1151.	1069.	1035.	987.	944.
906.	870.	835.	808.	780.	754.	740.	740.	740.	740.
739.	739.	739.	739.	739.	738.	738.	737.	737.	737.
736.	736.	736.	735.	735.	734.	734.	733.	733.	732.
731.	731.	730.	729.	728.	728.	727.	726.	725.	724.
723.	723.	722.	721.	720.	719.	718.	717.	716.	715.
714.	713.	711.	710.	708.	707.	705.	704.	702.	701.
699.	698.	696.	695.	693.	692.	691.	689.	688.	686.
685.	683.	681.	680.	678.	675.	674.	672.	671.	669.

STOR

7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
7.	7.	6.	6.	7.	7.	9.	11.	14.	19.
25.	33.	41.	51.	62.	74.	90.	110.	137.	174.
222.	288.	375.	494.	646.	833.	1058.	1359.	1748.	2174.
2541.	2762.	2845.	2855.	2835.	2804.	2768.	2734.	2702.	2674.
2649.	2622.	2591.	2558.	2527.	2497.	2469.	2444.	2422.	2403.
2386.	2371.	2357.	2346.	2336.	2329.	2322.	2316.	2311.	2307.
2303.	2299.	2295.	2292.	2289.	2287.	2284.	2280.	2277.	2272.
2266.	2261.	2254.	2247.	2240.	2232.	2223.	2214.	2205.	2195.
2185.	2174.	2163.	2151.	2139.	2125.	2111.	2096.	2081.	2065.
2048.	2030.	2011.	1991.	1971.	1949.	1927.	1905.	1881.	1858.
1833.	1809.	1784.	1758.	1733.	1707.	1681.	1655.	1629.	1603.
1577.	1551.	1525.	1499.	1473.	1447.	1422.	1396.	1370.	1344.
1319.	1293.	1267.	1242.	1216.	1191.	1165.	1140.	1114.	1089.
1064.	1038.	1013.	988.	963.	938.	913.	888.	863.	838.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	8438.	6046.	2497.	1188.	171122.
CMS	239.	171.	71.	34.	4846.
INCHES		2.96	4.89	6.96	6.98
MM		75.21	124.20	177.27	177.34
AC-FT		2999.	4952.	7069.	7071.
THOUS CU M		3699.	6109.	8719.	8722.

MAXIMUM STORAGE = 2855.

STATION 3, PLAN 1, RTIO 3

OUTFLOW

18.	18.	18.	16.	17.	17.	17.	17.	16.	16.
15.	16.	15.	15.	16.	17.	21.	26.	34.	45.
60.	77.	97.	119.	144.	173.	209.	257.	321.	369.
425.	504.	612.	661.	677.	698.	722.	1637.	8143.	12957.
14705.	14591.	13720.	12542.	11451.	10395.	9370.	8390.	7485.	6666.
5935.	5261.	4697.	4179.	3933.	3652.	3360.	3071.	2795.	2534.
2293.	2073.	1676.	1715.	1564.	1476.	1385.	1306.	1237.	1176.
1121.	1070.	1024.	981.	942.	906.	872.	840.	810.	783.
757.	740.	740.	740.	740.	739.	739.	739.	739.	738.
738.	738.	737.	737.	737.	736.	736.	736.	735.	735.
734.	734.	733.	733.	732.	731.	731.	730.	729.	729.
728.	727.	726.	725.	724.	724.	723.	722.	721.	720.
719.	718.	717.	716.	715.	714.	713.	711.	710.	708.
707.	705.	704.	702.	701.	700.	698.	697.	695.	694.
692.	691.	689.	688.	686.	685.	683.	682.	680.	678.

STOR

11.	11.	11.	11.	10.	10.	10.	10.	10.	10.
10.	9.	9.	9.	9.	10.	12.	16.	21.	27.
30.	46.	58.	72.	87.	104.	126.	155.	193.	246.
317.	415.	550.	729.	953.	1292.	1796.	2380.	2841.	3066.
3133.	3129.	3095.	3050.	3000.	2949.	2900.	2853.	2809.	2770.
2734.	2703.	2675.	2650.	2624.	2594.	2563.	2532.	2503.	2475.
2455.	2420.	2406.	2388.	2375.	2363.	2353.	2345.	2338.	2331.
2325.	2320.	2315.	2311.	2306.	2303.	2299.	2296.	2292.	2290.
2287.	2284.	2281.	2277.	2272.	2267.	2261.	2255.	2248.	2241.
2233.	2224.	2215.	2206.	2196.	2186.	2176.	2165.	2153.	2140.
2127.	2113.	2098.	2083.	2067.	2050.	2033.	2014.	1994.	1973.
1952.	1930.	1908.	1884.	1861.	1837.	1812.	1787.	1762.	1736.
1710.	1684.	1658.	1632.	1607.	1581.	1555.	1529.	1503.	1477.
1451.	1425.	1399.	1373.	1346.	1322.	1296.	1271.	1245.	1219.
1194.	1168.	1143.	1118.	1092.	1067.	1042.	1016.	991.	966.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	14705.	10776.	4181.	1760.	253463.
CMS	416.	305.	118.	50.	7177.
INCHES		5.28	8.19	10.34	10.34
MM		134.01	207.96	262.58	262.67
AC-FT		5343.	8292.	10470.	10474.
THOUS CU M		6591.	10228.	12915.	12919.

MAXIMUM STORAGE = 3133.

STATION 3, PLAN 1, RTIO 4

OUTFLOW

23.	23.	23.	23.	23.	22.	22.	22.	21.	21.
21.	20.	20.	20.	20.	22.	27.	34.	44.	59.
77.	99.	125.	154.	196.	223.	269.	330.	372.	427.
505.	512.	661.	679.	702.	728.	4018.	13790.	18723.	20149.
20111.	19266.	17927.	16332.	14685.	13102.	11771.	10669.	9599.	8596.
7678.	6847.	6097.	5427.	4840.	4330.	4018.	3757.	3474.	3188.
2909.	2644.	2397.	2179.	1993.	1836.	1704.	1592.	1497.	1413.
1339.	1272.	1211.	1155.	1104.	1056.	1012.	971.	933.	897.
864.	833.	804.	777.	752.	740.	740.	740.	740.	739.
739.	739.	739.	738.	738.	738.	737.	737.	737.	736.
736.	735.	735.	735.	734.	734.	733.	732.	732.	731.
731.	730.	729.	728.	728.	727.	726.	725.	724.	723.
722.	722.	721.	720.	719.	718.	717.	716.	715.	714.
713.	711.	710.	708.	707.	705.	704.	702.	701.	699.
698.	696.	695.	693.	692.	690.	689.	688.	686.	685.

STOR

14.	14.	14.	14.	14.	13.	13.	13.	13.	13.
12.	12.	12.	12.	12.	14.	16.	20.	27.	35.
46.	60.	75.	93.	112.	134.	162.	199.	249.	319.
416.	550.	731.	975.	1371.	1969.	2633.	3098.	3288.	3343.
3342.	3309.	3257.	3196.	3132.	3071.	3015.	2962.	2911.	2862.
2818.	2778.	2742.	2710.	2682.	2657.	2633.	2605.	2575.	2545.
2515.	2487.	2461.	2438.	2418.	2401.	2387.	2375.	2365.	2356.
2349.	2341.	2335.	2329.	2324.	2319.	2314.	2309.	2305.	2302.
2298.	2295.	2292.	2289.	2286.	2283.	2280.	2276.	2271.	2266.
2260.	2254.	2246.	2239.	2231.	2222.	2213.	2204.	2194.	2184.
2173.	2162.	2150.	2136.	2124.	2110.	2095.	2080.	2064.	2047.
2029.	2010.	1990.	1969.	1947.	1925.	1903.	1879.	1856.	1831.
1807.	1782.	1756.	1731.	1705.	1679.	1653.	1627.	1601.	1575.
1549.	1523.	1497.	1471.	1445.	1419.	1394.	1368.	1342.	1316.
1291.	1265.	1239.	1214.	1188.	1163.	1137.	1112.	1087.	1061.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	20149.	15294.	5891.	2337.	336682.
CMS	571.	433.	167.	66.	9534.
INCHES		7.49	11.54	13.73	13.74
MM		190.19	293.03	348.79	348.91
AC-FT		7584.	11684.	13908.	13912.
THOUS CU M		9355.	14413.	17155.	17161.

MAXIMUM STORAGE = 3343.

STATION 3, PLAN 1, RTIO 5

OUTFLOW

26.	26.	24.	26.	28.	27.	27.	27.	26.	26.
25.	25.	24.	24.	25.	28.	33.	41.	54.	72.
94.	121.	152.	187.	226.	272.	328.	367.	418.	489.
588.	658.	674.	696.	725.	4081.	15899.	22171.	24706.	25270.
24762.	23604.	21972.	20072.	18065.	16123.	14320.	12734.	11512.	10421.
9356.	8385.	7442.	6068.	5452.	5326.	4776.	4286.	4000.	3737.
3455.	3170.	2894.	2643.	2427.	2238.	2071.	1920.	1786.	1670.
1570.	1482.	1403.	1332.	1267.	1207.	1153.	1102.	1055.	1011.
970.	932.	897.	864.	833.	804.	777.	751.	740.	740.
740.	740.	739.	739.	739.	739.	738.	738.	738.	737.
737.	737.	736.	736.	736.	735.	735.	734.	734.	733.
732.	732.	731.	731.	730.	729.	728.	728.	.727.	726.
725.	724.	723.	722.	722.	721.	720.	719.	718.	717.
716.	715.	714.	713.	711.	710.	708.	707.	705.	704.
702.	701.	699.	698.	696.	695.	693.	692.	690.	689.

STOR

17.	17.	17.	17.	17.	17.	16.	16.	16.	16.
15.	15.	15.	15.	15.	17.	20.	25.	33.	43.
57.	73.	92.	113.	136.	164.	196.	244.	307.	396.
520.	569.	913.	1293.	1908.	2639.	3179.	3421.	3513.	3533.
3515.	3473.	3413.	3340.	3263.	3188.	3118.	3057.	3003.	2950.
2900.	2852.	2809.	2770.	2735.	2705.	2679.	2655.	2631.	2603.
2573.	2543.	2513.	2487.	2464.	2444.	2426.	2410.	2396.	2384.
2373.	2364.	2355.	2348.	2341.	2335.	2329.	232 .	2318.	2314.
2309.	2305.	2302.	2298.	2295.	2292.	2289.	2286.	2283.	2280.
2276.	2271.	2265.	2260.	2253.	2246.	2239.	2231.	2222.	2213.
2204.	2194.	2184.	2173.	2162.	2150.	2137.	2124.	2110.	2095.
2080.	2064.	2047.	2028.	2009.	1990.	1969.	1947.	1925.	1903.

1879.	1855.	1831.	1807.	1782.	1756.	1730.	1705.	1679.	1653.
1627.	1601.	1575.	1549.	1523.	1497.	1471.	1445.	1419.	1394.
1368.	1342.	1316.	1291.	1265.	1239.	1214.	1188.	1163.	1137.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	25270.	19792.	7610.	2919.	420422.
CMS	716.	560.	215.	83.	11905.
INCHES		9.69	14.90	17.15	17.15
MM		246.13	378.52	435.54	435.69
AC-FT		9814.	15093.	17367.	17373.
THOUS CU M		12106.	18617.	21422.	21429.

MAXIMUM STORAGE = 3533.

STATION 3, PLAN 1, RTIO 6

OUTFLOW

35.	35.	35.	35.	35.	34.	34.	33.	33.	32.
32.	31.	31.	30.	31.	35.	41.	52.	68.	89.
117.	150.	189.	232.	281.	334.	369.	416.	481.	574.
636.	672.	695.	724.	3980.	17475.	25523.	29584.	31404.	31729.
30979.	29417.	27300.	24902.	22419.	20103.	17885.	15869.	14095.	12595.
11444.	10351.	9269.	8304.	7424.	6650.	5966.	5356.	4809.	4319.
4018.	3760.	3480.	3212.	2972.	2756.	2560.	2381.	2217.	2065.
1924.	1795.	1682.	1582.	1494.	1416.	1344.	1279.	1219.	1163.
1112.	1065.	1020.	979.	940.	904.	871.	839.	810.	783.
757.	740.	740.	740.	740.	739.	739.	739.	739.	738.
738.	738.	737.	737.	737.	736.	736.	736.	735.	735.
734.	734.	733.	733.	732.	731.	731.	730.	729.	729.
728.	727.	726.	725.	724.	724.	723.	722.	721.	720.
719.	718.	717.	716	715.	714.	713.	711.	710.	708.
707.	705.	704.	702.	701.	700.	698.	697.	695.	694.

STOR

21.	21.	21.	21.	21.	21.	20.	20.	20.	19.
19.	19.	18.	18.	19.	21.	25.	31.	41.	54.
70.	90.	114.	140.	169.	203.	246.	305.	386.	502.
662.	975.	1235.	1847.	2629.	3240.	3542.	3689.	3755.	3767.
3740.	3683.	3607.	3520.	3430.	3341.	3256.	3178.	3110.	3052.
3000.	2947.	2896.	2848.	2806.	2769.	2736.	2707.	2680.	2657.
2633.	2605.	2576.	2547.	2522.	2499.	2476.	2459.	2442.	2426.

2411.	2397.	2385.	2374.	2365.	2357.	2349.	2342.	2336.	2330.
2324.	2319.	2315.	2310.	2306.	2302.	2299.	2296.	2292.	2290.
2287.	2284.	2281.	2277.	2272.	2267.	2261.	2255.	2248.	2241.
2233.	2224.	2215.	2206.	2196.	2186.	2176.	2165.	2153.	2140.
2127.	2113.	2098.	2083.	2067.	2050.	2033.	2014.	1994.	1973.
1952.	1930.	1908.	1884.	1861.	1837.	1812.	1787.	1762.	1736.
1710.	1684.	1658.	1632.	1606.	1581.	1555.	1529.	1503.	1477.
1451.	1425.	1399.	1373.	1348.	1322.	1296.	1271.	1245.	1219.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	31729.	25660.	9906.	3697.	532593.
CMS	898.	727.	281.	105.	15081.
INCHES		12.56	19.40	21.72	21.73
MM		319.10	492.76	551.75	551.93
AC-FT		12724.	19649.	22001.	22008.
THOUS CU M		15695.	24236.	27137.	27146.

MAXIMUM STORAGE = 3767.

********** ********** ********** ********** **********

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS					
				RATIO 1 0.20	RATIO 2 0.35	RATIO 3 0.50	RATIO 4 0.65	RATIO 5 0.80	RATIO 6 1.00
HYDROGRAPH AT	1	8.40	1	2779.	4863.	6948.	9032.	11116.	13895.
	(	10.86)	(	78.69)(	137.71)(	196.73)(	255.75)(	314.77)(	393.46)(
ROUTED TO	2	8.40	1	1014.	4293.	6795.	8919.	10975.	13719.
	(	10.86)	(	28.07)(	121.56)(	192.42)(	252.56)(	310.77)(	388.47)(
HYDROGRAPH AT	2	12.60	1	3943.	6900.	9857.	12815.	15772.	19715.
	(	32.63)	(	111.65)(	195.39)(	279.13)(	362.87)(	446.61)(	558.26)(
2 COMBINED	2	19.00	1	4353.	11045.	16105.	20953.	25788.	32235.
	(	49.21)	(	123.26)(	312.76)(	457.75)(	593.32)(	730.24)(	912.80)(
ROUTED TO	3	19.00	1	1414.	8438.	14705.	20149.	25270.	31729.
	(	49.21)	(	40.03)(	238.94)(	416.41)(	570.54)(	715.56)(	898.47)(

```
*********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  20 FEB 79
*********************************
```

APPENDIX D

DESIGN FOLDER

ISCHUA CREEK

WATERSHED PROTECTION PROJECT

DESIGN REPORT

Site 6A

Cattaraugus County

New York

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

INDEX

I- General
II- Layout
III- Hydraulic Design
IV- Foundation & Embankment Design
  A- Geology Report
  B- Soil Testing Report
  C- Analysis
V- Structural
VI- Quantities
VII- Specifications

January 29, 1965

ENGINEERING & WATERSHED
PLANNING UNIT
UPPER DARBY, PA

U. S. DEPARTMENT OF AGRICULTURE - SOIL CONSERVATION SERVICE

Multipurpose dam site No. 6A, of the Ischua Creek watershed protection project, is located approximately one-half mile southeast of Franklinville, New York, on Gates Creek, a tributary of Ischua Creek. Site No. 6A is in series and approximately 2.9 miles downstream from the completed site No. 5. Sheet 4 of this report, together with the Franklinville, N. Y. 15-minute quadrangle published by the U. S. Geological Survey, may be used to locate the structure more definitely.

A summary of pertinent design information is given on sheet 2 of this report.

Criteria and procedures used in this design are given in the following Soil Conservation Service publications:

National Engineering Memorandum No. 27, Limiting Criteria for the Design of Earth Dams
National Engineering Memorandum No. 42, Reinforced Concrete Pipe Drop Inlet Barrels
National Engineering Memorandum No. 50, Pipe Drop Inlet Type Principal Spillways
National Engineering Handbook No. 4, Hydrology
National Engineering Handbook No. 5, Hydraulics
National Engineering Handbook No. 6, Structural Design
National Engineering Handbook No. 8, Geology
Engineering Division Technical Release No. 2, Earth Spillways
Engineering Division Technical Release No. 5, Structural Design of Underground Conduits
Engineering Division Technical Release No. 10, Storage--Floodwater Retarding Structures
Engineering Division Technical Release No. 12, Procedure for Computing Sediment Requirements for Retarding Reservoirs
Upper Darby Method of Reservoir Flood Routing

This is one of eight proposed floodwater retarding dams in the Ischua Creek watershed designed to reduce floodwater damages. It will retard a 100-year frequency storm without discharge occurring in the emergency spillway. The permanent pool has a water surface area of 80 acres and a beneficial storage volume of 972 acre-feet in addition to the 50-year sediment storage.

The results of hydrologic and hydraulic computations are given on sheet 3 of this report.

The structure consists of a compacted earth fill with a cutoff through alluvial gravel to firm sandstone in the left abutment and to firm, relatively impervious glacial till in the flood plain and right abutment. A drainage system is located under the downstream portion of the earth fill to control the phreatic surface and to collect seepage.

The principal spillway system is two parallel drop inlet structures each consisting of a single stage reinforced concrete riser, 42-inch diameter reinforced concrete water pipe, and a reinforced concrete impact basin to dissipate the energy of high velocity discharge at the outlet end of the pipe.

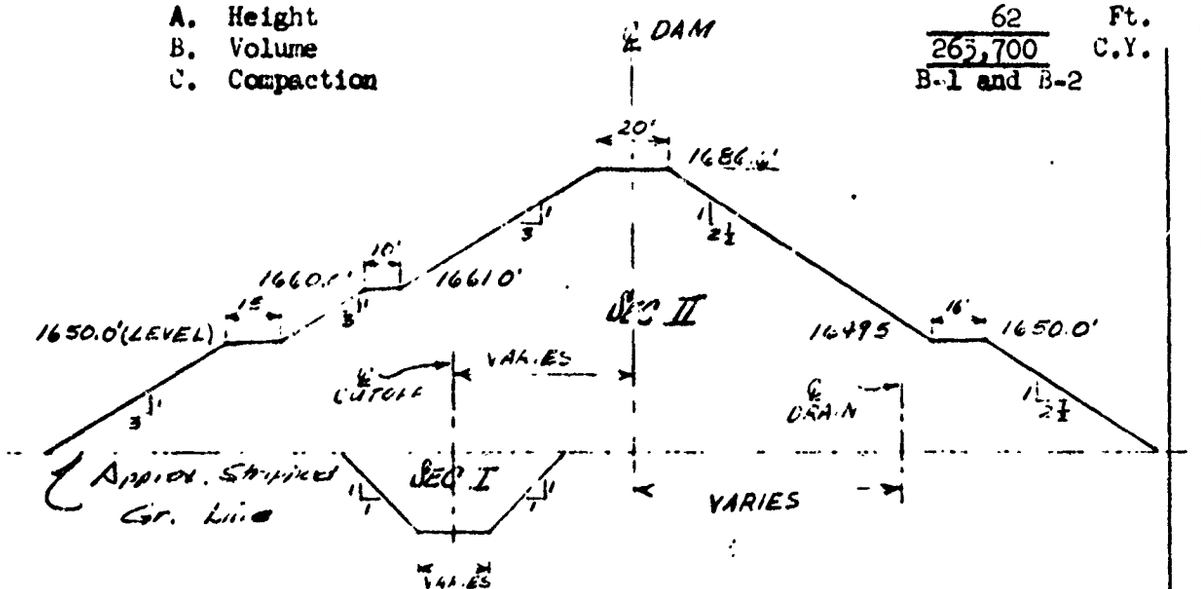
ENGINEERING & WATERSHED PLANNING UNIT, UPPER DARBY, PA.

The emergency spillway system is designed as an earth cut in each abutment with the control section on firm, compact glacial till. An engineering cost analysis was performed which led to the elimination of rock excavation in the left emergency spillway.

U S DEPARTMENT OF AGRICULTURE - SOIL CONSERVATION SERVICE

DESIGN REPORT SUMMARY

I.	Watershed data		
	A. Structure class	(c)	
	B. Drainage area	8.064	Ac.
	C. Time of concentration - T_c	4.2	Hrs.
	D. Hydrologic curve number - C_n		
	1. Moisture condition II	78	
	2. Moisture condition III	93	
II.	Principal spillway (two parallel systems)		
	A. Conduit		
	1. Size (I.D.)	42	In.
	2. Length	240.33	Ft.
	B. Riser		
	1. Size	3.5x10.5	Ft.
	2. Height	34	Ft.
	C. Weir length	19	Ft.
	D. Orifice size		In.
	E. Pond drain size	30	In.
	F. Type of energy dissipator	concrete impact basin	
III.	Emergency spillway		
	A. Width	200 and 300	Ft.
	B. Side slopes	3:1	
	C. Length of level section	30	Ft.
	D. Exit slope	0.022	Ft/Ft.
	E. Maximum velocity at control section (D.H.W.)	9.6	Ft/Sec.
	F. Duration of flow (D.H.W.) through emergency spillway	15.84	Hrs.
	G. Frequency of use	less than once in 100 years	
IV.	Earth fill		
	A. Height	62	Ft.
	B. Volume	265,700	C.Y.
	C. Compaction	B-1 and B-2	



Typical Cross Section

ENGINEERING & WATERSHED PLANNING UNIT, UPPER DARBY, PA.

U. S. DEPARTMENT OF AGRICULTURE - SOIL CONSERVATION SERVICE

Element of Structure	Determining Factor	Elevation	Surface Area Acres	Storage		Inflow		Peak Outflow c.f.s.
				Acre-Feet	Inches*	Volume Inches*	Rate c.f.s.	
Invert of orifice	50-year sediment accumulation							
Crest of riser	50-year sediment accumulation plus 972 ac-ft of beneficial storage	1661.0	80	1110	1.65	-	-	-
Crest of emergency spillway 1/	10-year frequency storm, moisture condition III (TR-10 procedure)	1679.0	174	2265 2/	3.37	-	-	651
Design high water	1.75 X 6-hour point rainfall, moisture condition II	1684.2	204	3200 2/	4.76	8.5	17,450	15,200
Top of dam	2.5 X 6-hour point rainfall, moisture condition II	1686.6	216	3690 2/	5.49	13.3	30,100	28,200

*Inches of runoff from controlled area of 8064 acres
Time required to empty flood storage is 4.5 days

1/ Raised 4.8' based on engineering cost analysis.
2/ Does not include any storage allocated to permanent pool.

ENGINEERING & WATERSHED PLANNING UNIT, UPPER DARBY, PA

ISCHUA CREEK WATERSHED
SITE 6A NY-1001-D

HYDROLOGY AND HYDRAULICS SUPPLEMENT

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UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Syracuse, New York 13210

SUBJECT: ENG 13 - Ischua Creek Site 6A
Revised Hydrology and Hydraulics

DATE: 8/6/70

TO: THE FILES

Summary of Revised Hydrology and Hydraulics for Ischua Site 6A Emergency Spillway and Freeboard Hydrographs.

Due to an excess of Excavation from the Emergency Spillways, a revision in the bottom width of the right emergency spillway was determined to avoid wasting of excavation.

Criteria used is the same as the original design with the exception of the Emergency Spillway Hydrograph minimum point rainfall. The minimum used was to be either (1) 1.00 times the design point rainfall (1.00 x 7.9") modified by the previous Areal Rainfall Factor OR: (2) the point rainfall called for under the current Engineering Memorandum #27 (Rev.) (9.0") modified by the current areal rainfall factor. A summary of the data used for the routings is attached.

Several bottom widths were run, with a resulting bottom width of 450' total used. This reduces the right emergency spillway bottom width from 300' to 250'. The design high water elevation is lowered to 1682.9 from 1684.2 and the top of dam is raised to 1687.2 from 1686.6. The design high water is lowered because the point rainfall for the emergency hydrograph that was used in the original design was 1.75 (7.9"). The top width of the dam is to remain the same as the original design (20 ft.). The resulting steepening of the side slopes is felt to have an insignificant effect upon the stability of the dam. The above mentioned changes were discussed between L. Ibbitson and G. Oman on August 4 and 5, 1970.

SCS-523 REV 5-58

SOIL CONSERVATION SERVICE

GPO. 1958 O—470667

STATE	PROJECT		
NEW YORK	ISHUA CREEK SITE 6A		
BY JEP / DATE 8-5-70	CHECKED BY	DATE	JOB NO. NY-1001-D

SUBJECT EM. SPLWY. & FREEBOARD HYDROGRAPH RESULTS — SHEET ___ OF Pg 1-3

SITE 6A

EM. SPLWY. HYDROGRAPH RESULTS

B.W.	Q	D.H.W.	Qp	QEM.	QEM/b	V
450	7265	1682.9	676	6589	14.6	8.6 FT/SEC
500	7439	1682.7	674	6765	13.5	8.3 FT/SEC

FREEBOARD HYDROGRAPH RESULTS

B.W.	Q.	TOP DAM
450	28,675	1687.2
500	28,987	1686.8

NOTE: Hp & Q/b VALUES FOR COMPUTER ROUTINES BASED UPON S = 0.00 ENTRANCE SLOPES FOR 6A EM. SPLWYS.

COMPUTATION SHEET
SCS-522 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE N.Y. PROJECT [illegible] #6A
BY TCP DATE 12/1/64 CHECKED BY [illegible] DATE [illegible] JOB NO. NY-1001-E
SUBJECT Piping & Cracking SHEET 2 OF

Sample	Depth	U.S.C.S.	D_{50} mm	P. I.	L.L.	% 0.005 mm	Piping*	Cracking*	Remarks
202.1	1'-4'	CL	0.047	8	26	23	1	2	
202.2	4'-5'	SM	0.135	7	17	12	1	2	
202.3	5'-13'	CL	0.070	8	25	27	1	2	
207.1	1'-10'	CL or CL-ML	0.072	7	22	21	1	2	
207.2	10'-12'	CL or CL-ML	0.068	7	23	22	1	2	

* Degree of susceptibility (1 greatest to 6 least) taken from "FLEXABILITY OF CLAY AND CRACKING OF EARTH DAMS" by Leonards & Narain, ASCE proceedings Vol. 89, SM 2, March 1963, PP 50 + 51.

All samples meet all filter criteria for contact with any adjacent soil.

COMPUTATION SHEET
SCS-522 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE NEW YORK | PROJECT ISCHUA CR. SITE 6A
BY WC | DATE 10/31/64 | CHECKED BY JCP | DATE 1/4/65 | JOB NO NY-1001-E
SUBJECT DRAINAGE DESIGN | SHEET 5 OF

The Drainage System is designed based on the information contained in the Geologic & Soils Reports

The Drain is located 100 FT. downstream from the ℄ of Dam. It extends on each side of the principal spillway parallel to the ℄ of Dam to the toe of slope at each abutment. This portion of the Drain is 3.0 wide and will bottom on the Glacial Till. This Till is approx 11 to 12 FT below the ground surface. At the Toe of Slope in each abutment the Drain angles toward the ℄ of Dam in order it may be retained within the embankment and from the angle up it will have a width of 10 FT. This portion will extend to bed rock or to a min. depth of 6.0 FT. below the stripping Line and will continue up the side of each abutment to the Elevation of the Normal Pool.

The Drain will outlet thru a 10" B.C.C.M.P. starting from the Toe of Slope in each abutment. It will Turn at the principal spillway and run parallel there to and Terminate in the in the "Bift" below the baffle.

The portion of the Drain extending up each abutment will be filled with Flood Plain Material as represented in Sample 65W213. The rest of the Drain will contain Designed Filter Material as set forth in Soils Lab. Report Form 353

~~The Filter Material will not extend above the stripping Line since the Drain will be [illegible] upward from the [illegible] and Terminate in the [illegible] Drain~~

COMPUTATION SHEET
SCS-522 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE: NEW YORK | PROJECT: Ischua Creek #6A
BY: WJC | DATE: 12/26/64 | CHECKED BY: TOP | DATE: 1-4/65 | JOB NO. NY-1001-E
SUBJECT: DESIGN OF CUTOFF TRENCH | SHEET 12 OF

The Cutoff Trench is designed based upon information contained in the Geologic & Soils Laboratory Report.

The bottom width (w) is based upon Formula —
(Min) → w = h - d. I. w = H - d/2
h = head from Normal Pool to Gr. Surface
d = Depth of Cutoff Trench below Gr. Surface
H = head from Emergency Spillway to Gr. Surface

w = H - d/2

GEOLOGY REPORT

SITE 6A

ISCHUA CREEK

FRANKLINVILLE

NEW YORK

APPROVAL:

W. S. Atkinson
State Conservation Engineer

PREPARED BY:

B. S. Ellis
Bernard S. Ellis
Geologist

REFERENCE:	U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	DRAWING NO. NY-1001-G SHEET ___ OF ___ DATE July 64

Sheet 1 of _____

10-59

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

GENERAL

State New York County Cattaraugus ¼, ¼, Sec. ____, T ____ R ____ ; Watershed Ischua Creek

Subwatershed Gates Creek Fund class WP-2-1 (FP-2, WP-1, etc.) Site number 6A Site group --- Structure class C

Investigated by B. S. Ellis Geologist (signature and title) Equipment used Backhoe, Drill Rig (Type, size, make, model, etc.) Date 7/64

SITE DATA

Drainage area size 19.1 sq. mi., 12,224 acres. Type of structure Earth Fill Purpose Multi-purpose

Direction of valley trend (downstream) Northwest Maximum height of fill 60 feet. Length of fill 1050 feet.

Estimated volume of compacted fill required 263,700 yards

STORAGE ALLOCATION

	Volume (ac. ft.)	Surface Area (acres)	Depth at Dam (feet)
Sediment	138	23	11
Floodwater	2265	175	49
Recreation	972	80	31

SURFACE GEOLOGY AND PHYSIOGRAPHY

Physiographic description Allegheny Plateau Topography Mod. steep Attitude of beds: Dip --- Strike ---

Steepness of abutments: Left 36 percent; Right 36 percent. Width of floodplain at centerline of dam 450 feet

General geology of site: This site is located in the Allegheny Plateau physiographic province. Specifically, it is 17 miles north of Olean, New York, and a mile SE of the village of Franklinville.

The topography in the area is generally of the glacial-depositional type of the Binghamton drift. Morainal deposits are common in the area. The material in the uplands is predominantly till with occasional kames and kame terraces of gravel. The Binghamton drift is characterized by an abundance of both igneous erratics and of limestones.

Morainal deposits plugged the north end of the main valley of Ischua Creek, bringing about drainage reversal and post-glacial drainage to the south. During intermediate stages, a glacial lake was formed in the Ischua valley. Deep sand deposits occur a short distance downstream from this C/L, indicating proximity to an old glacial lake shore line.

Underlying bedrock is interbedded shales and sandstone of Devonian Age. This bedrock was encountered in drilling the left emergency spillway and in the backhoe pits in the flood plain adjacent to the steep left abutment.

Form SCS 376B
Sheet ___ of ___

USDA SCS

10-59

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

FEATURE Centerline of Dam
(Centerline of Dam, Principal Spillway, Emergency Spillway, the Stream Channel, Investigations for Drainage of Structure, Borrow Area, Reservoir Basin, etc.)

DRILLING PROGRAM

Equipment Used	Number of Holes		Number of Samples Taken		
	Exploration	Sampling	Undisturbed (state type)	Disturbed Large	Disturbed Small
Backhoe	7	---	---	---	---
Drill Rig	3	3	---	---	30
Total	10	3	---	---	30

SUMMARY OF FINDINGS
(include only factual data)

Both the left and right abutments of this site consist of dense glacial till. This till also underlies the flood plain at depths ranging from 7' to 10'. At the intersection of the left abutment and the flood plain, bedrock occurs at about a 4' depth, dropping off under the flood plain to a depth exceeding 29' in the vicinity of D.H. #6.

The till in the abutments and under the flood plain is very dense, with very low permeability. The overlying gravels in the flood plain are permeable, with a considerable amount of seepage occuring at the 3'-5' depth. The stream in this flood plain is influent for a major portion of the year, with a considerable amount of water moving downstream in these gravels.

The bedrock under the left abutment is an interbedded sandstone and shale. Bedding is fairly thick, ranging from 1.5' to 3.0'.

Form SCS-3768
Sheet ___ of ___

USDA-SCS

10-59

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

FEATURE Emergency Spillway
(Centerline of Dam, Principal Spillway, Emergency Spillway, the Stream Channel, Investigations for Drainage of Structure, Borrow Area, Reservoir Basin, etc.)

DRILLING PROGRAM

Equipment Used	Number of Holes		Number of Samples Taken		
			Undisturbed	Disturbed	
	Exploration	Sampling	(state type)	Large	Small
Backhoe	18	2	--	6	--
Drill Rig	8	8	--	--	45
Total	26	10	--	6	45

SUMMARY OF FINDINGS
(include only factual data)

Glacial till occurs quite uniformly over the entire emergency spillway excavation area.

Generally speaking, the material is homogeneous from the standpoint of engineering characteristics. There is, however, a definite break in color, with blue-gray till overlain by brown till.

The left spillway is underlain by bedrock, with a portion of it occurring above design grade line. There is an estimated 200 cu. yds. of rock removal.

Areas of relatively clean sand and some silt occur in localized areas in the left spillway. None was encountered in the test pits in the right spillway.

All of the borrow will come from the emergency spillway excavation.

Form SCS 376B
Sheet ___ of ___

USDA-SCS

10-59

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

FEATURE Principal Spillway
(Centerline of Dam, Principal Spillway, Emergency Spillway, the Stream Channel, Investigations for Drainage of Structure, Borrow Area, Reservoir Basin, etc.)

DRILLING PROGRAM

Equipment Used	Number of Holes		Number of Samples Taken		
			Undisturbed	Disturbed	
	Exploration	Sampling	(state type)	Large	Small
Backhoe	3	---	---	---	---
Total	3	---	---	---	---

SUMMARY OF FINDINGS
(Include only factual data)

The dense glacial till uniformly underlies the entire extent of the principal spillway. This till was encountered at an average depth of 10' in all three test pits.

Over the till, the material is a fairly clean coarse gravel. In all three pits, heavy seepage was encountered in these gravels.

Ground water table appears to be somewhere in the 3'-5' zone, depending on the area. Recharge is fairly high.

10-69

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

FEATURE Foundation Drain

(Centerline of Dam, Principal Spillway, Emergency Spillway, the Stream Channel, Investigations for Drainage of Structure, Borrow Area, Reservoir Basin, etc.)

DRILLING PROGRAM

Equipment Used	Number of Holes		Number of Samples Taken		
	Exploration	Sampling	Undisturbed (state type)	Disturbed Large	Disturbed Small
Backhoe	3	3	---	3	---
Total	3	3	---	3	---

SUMMARY OF FINDINGS

(Include only factual data)

These three pits were dug near the downstream toe of the dam, slightly downstream from the probable location of the drain.

The material encountered was essentially the same as that logged upstream at the C/L location. The glacial till occurs at a slightly shallower depth, being logged at a uniform depth of 7' in these three pits.

The three samples taken were of the gravels overlying the till.

Form SCS-376C
Sheet __ of __
For A-Service Use Only

USDA-SCS

10-59

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

State New York County Cattaraugus Watershed Ischua Creek Subwatershed Gates Creek

Site number 6A Site group C Structure class _____ Investigated by BSEllis, Geologist (signature and title) Date 7/64

INTERPRETATIONS AND CONCLUSIONS

Centerline of Dam

With dense till and bedrock underlying the entire extent of the C/L of the dam, foundation problems are pretty much at a minimum on this site. Blow count in the surficial gravels is quite high, and very high in the underlying till. The bedrock surface, as shown in the detail sketch of the area near T.P. #4, is dipping at a moderately shallow angle. This, coupled with the extremely dense till, should obviate the need to consider differential settlement between the rock and the till as a problem.

The 10' or so of gravel and silt overlying the till is, of course, permeable. Seepage into these flood plain test pits was fairly rapid. The GWT in these gravels will, of course, drop during July, August and September, but I feel that there is a good possibility of water in them at any time of the year.

We will need to install a cutoff through these gravels and at least 2' into the underlying till. In the left abutment, a key should be cut into unweathered bedrock to carry the cutoff across the extent of the flood plain and abutments.

There did not appear to be any seep areas on either abutment, or at the junction of the flood plain and the abutments. There is, however, a possibility that some minor seepage will be picked up in the left abutment when the area is scalped. It would be a rare situation if no ground water was seeping out of the rock at this point. However, I do not feel that the amount will be significant.

Both abutments should be flattened somewhat to meet the requirement of a 1:1 slope or flatter for compaction.

Bedrock exposed in the stream downstream from the C/L of dam is flat-lying, and the cores recovered from the drill holes also indicate horizontal bedding.

There is a question in my mind as to how much of the flood plain material should be scalped under the base area of the dam. With the exception of the upper portion of D.H. #5, blow count in the "clean" gravels is quite high. Excavation of the cutoff trench and the principal spillway trench down to till and backfilling with embankment material will set up a condition for moderate differential settlement. Consideration should be given to the removal of enough of these gravels in order to minimize this problem.

We have had some trouble with softening of till foundations when we have excavated a trench in saturated flood plain gravels. The water seeps into the trench from the gravel and equipment moving in the trench works the water into the silt fraction of the till. The till softens, and further excavation is required. I would suggest that an upstream diversion be constructed to drain and divert the water away from proposed excavations in the foundation.

Form SCS 376C
Sheet ___ of ___
For In-Service Use Only

USDA-SCS

10-69

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

State New York County Cattaraugus Watershed Ischua Creek Subwatershed Gates Creek

Site number 6A Site group C Structure class -- Investigated by B.S. Ellis, Geologist (signature and title) Date 7/64

INTERPRETATIONS AND CONCLUSIONS (continued)

Emergency Spillway

As indicated in the front of this report, the emergency spillways are predominantly glacial till. The right spillway is somewhat more homogeneous than the left. The backhoe pits, to a depth of 13', revealed only a slight variation in texture and a change in color from brown to bluish gray at a depth of about 8'. The drill holes, carried to greater depths, validated this information.

In the left spillway, an area of sand and silt exists in the vicinity of T.P. Nos. 253 and 254. This material was wet in place, and we can probably expect some stability problems with it when the spillway is excavated. This situation is quite similar to the outside slope of the emergency spillway on Site #16, Conewango Creek Watershed. However, I still feel that it would be wiser to excavate with normal side slopes and then go back in and blanket with heavy gravel if we have trouble with this material on these slopes. Behavior of the material on Site #16 may give us a clue as to what to expect on this site. It appears that the volume of sand and silt involved is rather small and that the area covered is fairly restricted. It is conceivable that pans could mix this in with the till at least to some extent. This would cut down the amount that we would have to spoil.

Bedrock underlies much of the left emergency spillway area. The rock surface was delineated in a number of places with drill holes and backhoe pits. A contour map of this surface was interpolated from this information. Rock excavation is estimated to be in the neighborhood of 200 cu. yds. Rippability of this rock is quite variable, as shown in the photo of the cores recovered from the drill holes. However, with this small amount, determination of rippability of the rock would seem to be a rather inconsequential item.

Principal Spillway

Dense glacial till underlies the entire extent of the proposed C/L of the principal spillway. While I did not have any drill holes at this exact location, it is logical to assume that the blow count data for the three drill holes along the C/L of dam would be valid for the materials along the principal spillway.

I recommend that the trench be excavated down to the glacial till and backfilled with select material from the emergency spillway excavation. While I cannot predict the location of the GWT at the time of construction, I would like to re-emphasize the need for at least consideration of some type of dewatering of these gravels. This procedure should minimize the softening of the underlying till with the resultant need to over excavated.

GENERAL

Test pits dug for the initial downstream location of this dam revealed about 10' of gravelly material underlain by sand over much of the flood plain area. I visually classified this material as a GP or GW. The outlet channel for the present C/L location will need to be designed for this gravel.

Form SCS 376C
Sheet ___ of ___
For IT Service Use Only

USDA-SCS

10-69

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

State New York County Cattaraugus Watershed Ischua Creek Subwatershed Gates Creek

Site number 6A Site group C Structure class --- Investigated by Geologist (signature and title) Date 7/64

INTERPRETATIONS AND CONCLUSIONS (continued)

The basin behind this structure is very similar to the basin behind Site #5, further upstream on this tributary. With dense till and bedrock as a cutoff point under the C/L of this dam, I do not feel that seepage losses will effect the maintenance of a permanent pool behind this structure. Site #5 has held a permanent pool very well, with a less positive cutoff.

Pressure tests were run in the bedrock. As indicated in the logs, moderate water loss was experienced in some horizons. However, it should be borne in mind that this is a horizontal transmission of water, rather than vertical. It is entirely logical to assume that vertical transmission of water from the pool into these more permeable zones in the rock would be a lot lower than the pressure tests would seem to indicate. The photo of the rock core recovered from D.H. #7 shows good solid rock from 15.5 to 18.5, with a fractured zone from 18.5 to 21.0. The 3 G.P.M. loss undoubtedly occurred in this fractured zone. Vertical permeability would appear to be near zero. If it is felt that the seepage losses through the rock will be excessive, it should be possible to blanket the west side of the flood plain for the required distance upstream. I do not feel that any seepage will occur in the till underlying the central and east side of the flood plain, therefore, the need to blanket would be confined to the west side.

All of the fill material will come from the emergency spillway excavation, therefore, no separate borrow investigation was made.

I do not believe that the "clean" gravels encountered in the flood plain will be suitable for drainage or filter material. There are two large commercial sources of washed and screened sand and gravel nearby in this watershed, therefore, the cost will not be excessive for imported material.

OPTIONAL FORM NO. 10
5010-104

UNITED STATES GOVERNMENT

Memorandum

TO : W. S. Atkinson, State Conservation Engineer, SCS, Syracuse, New York 13210 **DATE:** September 9, 1964

FROM : Rey S. Decker, Head, Soil Mechanics Laboratory, SCS, Lincoln, Nebraska 68508

SUBJECT: ENG - Soil Tests 18 - New York WP-08, Ischua Creek, Site No. 6A (Cattaraugus County)

ATTACHMENTS

1. Form SCS-354, Soil Mechanics Laboratory Data, 2 sheets.
2. Form SCS-355, Triaxial Shear Test Data, 2 sheets.
3. Form SCS-352, Compaction and Penetration Resistance Report, 5 sheets.
4. Form SCS-353, Filter Design, 1 sheet.
5. Form SCS-357, Summary - Slope Stability Analysis, 3 sheets.
6. Investigational Plans and Profiles.

DISCUSSION

FOUNDATION

A. Classification: The foundation at this site consists of glacial till on the abutments and alluvial silts and gravels overlying glacial till in the floodplain.

The glacial till on the left abutment is underlain by bedrock at depths of from about 4 feet at the base of the left abutment to a depth of about 20 feet at the inside edge of the emergency spillway.

Bedrock was not reached within the investigational depth on the right abutment. Hole No. 271 in the emergency spillway on this abutment was drilled to a depth of 45 feet.

The floodplain silts and gravels are about 8 to 10 feet thick and overlie glacial till except in the area at the base of the right abutment where the floodplain sediments directly overlie bedrock.

B. Density: The glacial till on the abutments and in the floodplain is described as dense. Blow count values in the till in the floodplain section ranged from about 35 to greater than 100 blows/foot.

On Site 4 in this watershed a GM glacial till that contained 30 percent gravel and about 45 percent fines had an in-place density of about 130 p.c.f. Based on the high blow count we would expect the in-place density of the GM in the floodplain section to exceed 120 p.c.f. also.

Blow counts in the alluvial gravel zone ranged from 12 to 86 blows/foot. The ML in drill hole No. 7 has a penetration resistance of 39 blows/foot. The relative density of the 12 to 13-blow-per-foot alluvial GM is judged to be in the range of 70 percent.

C. Strength: Blow count data indicates that the alluvium will have lower shear strength values than the glacial till. Based on the indicated relative density of the alluvium, we suggest design shear strength values of $\phi = 35°$, $c = 0$ for the alluvium. The suggested values are based on the assumption that the bulk of the ML surface zone in the floodplain will be removed during site preparation.

D. Consolidation: The blow count tests indicate a dense till; therefore, consolidation within the till is expected to be very low.

Some consolidation may be expected within the alluvium. The potential is expected to be fairly low, however, and the settlement is expected to occur during the construction period.

Differential settlement is not expected to be a problem in the area of the bedrock contact near the base of the left abutment. The slope of the bedrock appears to be slightly flatter than 2:1 and consolidation within the dense till is expected to be minor.

E. Permeability: The Geologist expects the dense till on the abutments and in the floodplain to have a very low permeability rate.

Moderate water loss occurred in some horizons in the bedrock. The Geologist compares the conditions at this site to Site 5 on this watershed, however, and states that Site 5 has held a permanent pool very well.

EMBANKMENT

A. Classification: The borrow material will be obtained from the emergency spillways. Three samples from the right spillway and two samples from the left spillway were submitted to the laboratory. The samples indicate a fairly uniform material that contains about 25 percent gravel and about 50 percent fines. The liquid limits range from 17 to 26 and the PI's range from 1 to 8. These samples are classed as CL, CL-ML and SM.

B. Compacted Density: Standard Proctor density tests were made on the fraction finer than the 3/4-inch size as requested. The compaction tests were made on Samples 65W214, 65W216 and 65W217. In addition to

the compaction tests on the minus 3/4 fraction, Proctor tests were made on the minus 4 fraction of Samples 65W214 and 65W217.

The density obtained on the minus 4 fraction when the gravel up to 3/4 in. was included was slightly less (98% to 99%) than obtained when only the minus 4 material was compacted. The tests were made in 1/30 cubic foot molds and some interference probably occurred between the gravel particles and the mold which resulted in the slightly lower minus 4 density when the gravel was included.

C. Shear Strength: Triaxial shear tests were made on Samples 65W214 and 65W217. The tests were made on the minus 4 fraction. The tests were made on specimens molded to about 93.5 to 94.5 percent of Standard Proctor density. The samples were soaked to saturation prior to placement in the shear chambers. The consolidated, undrained shear values obtained were $\phi = 21.5°$, $c = 300$ p.s.f. on Sample 65W214 and $\phi = 19°$, $c = 425$ p.s.f. on Sample 65W217. These values are in the same range as test values obtained on the minus 4 material from Site 4 in this watershed and are suggested for design.

SLOPE STABILITY

Slope stability was checked with a modified Swedish circle method of analysis. The analysis was based on an embankment height of 61.6 feet. A phreatic line was assumed from emergency spillway elevation to a drain at $c/b = 0.6$. The embankment was considered as homogeneous and was analyzed for shear strength values of $\phi = 21.5°$, $c = 300$ p.s.f. and for shear strength values of $\phi = 19°$, $c = 425$ p.s.f. Foundation strength values of $\phi = 35°$, $c = 0$ were assumed for the alluvium and the strength of the underlying till was considered to be high enough so that a failure arc would not penetrate it.

The analysis shows that a 25-foot berm is required on the proposed 3:1 upstream slope and that a 16-foot berm is required on the proposed 2 1/2:1 downstream slope in order to obtain satisfactory factors of safety. The berm widths, elevations and factors of safety obtained are shown in the following summary:

Slope	Trial No.	Berm		F_s
		Width	Elevation	
3:1 Upstream	3	25 feet	1660	1.35
2 1/2:1 Downstream	5A and 6B	16 feet	1650	1.49
2 1/2:1 Downstream	8	10 feet	1650	1.48

4 -- W. S. Atkinson -- 9/9/64
Rey S. Decker
Subj: ENG - Soil Tests 18 - New York WP-08, Ischua Creek, Site No. 6A
(Cattaraugus County)

Trial Arc Nos. 3, 5A and 6 did not penetrate the foundation. Trial Arc No. 8 penetrated the foundation to a 10-foot depth. This condition was not the limiting one but is listed above for comparative purposes.

A complete summary of the analysis is attached (Form SCS-357).

RECOMMENDATIONS

A. Site Preparation: The geology report and the log for T.P. 1 make reference to steep portions on the abutments. These steep areas should be flattened to about 2:1 in order to insure a good bond and reduce the danger of differential settlement.

B. Cutoff Trench: A cutoff trench with a minimum depth of 5 feet is suggested for the abutments. At this depth we anticipate that the trench bottom will be below the zone affected by surface weathering. In the floodplain section the trench should bottom in firm GM glacial till to right of ℄ Station 8+00. On the left side of ℄ Station 8+00 and on the lower portion of the right abutment the trench should bottom on bedrock.

A normal trench width will be adequate except where the trench bottoms on bedrock. Where the trench bottoms on bedrock, we recommend a minimum trench width of 24 feet.

The trench should be backfilled with CL material like Sample 65W214. We are assuming that the gravelly alluvium will have a low consolidation potential; therefore, we recommend that the trench backfill be compacted to 100 percent of Standard Proctor density.

The Geologist has indicated that the till underlying the gravelly alluvium is likely to soften unless the foundation is dewatered. This situation is quite typical in low plasticity materials. We recommend dewatering prior to excavation to insure that the till does not soften. A loss in density within the till would reduce the effectiveness of the cutoff and also increase the consolidation potential.

C. Principal Spillway: The foundation conditions at the proposed location (approximately ℄ Station 11+50) are quite uniform. About 10 feet of alluvial gravel logged as GW overlies dense glacial till which is logged as GM.

The Geologist suggests that the pipe trench be excavated to glacial till and backfilled to grade with compacted materials. We assume that variations are expected within the alluvium. Samples from the drain line indicate

that alluvium can vary from a medium SM to a GM-GP. Excavation to the till would insure a uniform foundation for the conduit. The trench backfill should consist of CL like Sample 65W214 compacted to at least 100 percent of Standard Proctor. Dewatering will undoubtedly be required to prevent softening of the till if the excavation is carried to the till.

D. Drain: A drain is recommended to provide a safe outlet for seepage that bypasses the cutoff trench through the glacial till and through the bedrock. A drain is also required to control the phreatic line.

The bedrock occurs within close proximity of the surface at the drain location on the left abutment. For the drain on this abutment we suggest that GM-GP material from the floodplain like Sample 65W213 be used. The GM-GP could be placed as a blanket in a dozer trench that bottoms on bedrock. This drain should extend up the abutment to normal pool level or to a point where the mantle reaches a thickness of about 8 feet, whichever occurs first.

A drain trench depth of about 6 feet is suggested for the right abutment. The drain on this abutment may either be constructed as a narrow trench with a designed filter or it may be constructed as a wide trench (8-12 feet) with GM-GP from the floodplain used as the drain material.

The drainage requirements for the floodplain section depend upon the extent of the material like Sample 65W212 from T.P. 77. The sample received from this pit is an SM that contains 34 percent fines. The zone represented by Sample 65W212 was logged as GW-GM, however, and we are not certain that the sample received is representative. If the floodplain materials at the drain location consist primarily of GM-GP like Samples 65W211 and 65W213, the only requirement would be to provide a controlled outlet. It appears that a pipe outlet with a designed filter would be most economical unless rock is readily available for a rock toe. The suggested filter limits for the outlet drain are shown on the attached Form SCS-353.

If Sample 65W212 is representative, areas such as this can be handled by enlarging the drain trench in these areas and placing GM-GP between the base and the filter. Placement of GM-GP like Samples 65W211 and 65W213 will also be required between the embankment material and the filter outlet.

E. Embankment Design:

1. Selection of Material. The borrow material will be obtained from the emergency spillways. Samples from both spillways indicate a

fairly uniform material; therefore, a homogeneous embankment is recommended. The embankment material should be placed at a minimum of 95 percent of Standard Proctor density. The placement moisture content should be controlled to near optimum.

The field control may be based on either the minus 4 or the minus 3/4-inch fractions. It appears, however, that field Proctor tests or control by Hilf's rapid method or something comparable will be required, however, since the minus 4 compacted density of the till ranges from 118 to 124.5 p.c.f. The range for the minus 3/4-inch fraction was about the same as the range for the minus 4.

There is some sand and silt encountered in the vicinity of T.P. Nos. 253 and 254 in the left spillway. The volume is expected to be small and we suggest that this type of material be placed above the phreatic line in the downstream section. The compaction requirement should be at least 95% of Standard Proctor for this type of material also.

2. Slopes. The following slopes have acceptable factors of safety and are recommended:

Upstream - 3:1 with a 25-foot berm at elevation 1660.

Downstream - 2 1/2:1 with a 16-foot berm at elevation 1650.

3. Settlement. An overfill allowance of 1.75 feet is suggested to compensate for residual settlement within the fill and foundation.

Prepared by:

Lorn P. Dunnigan

Lorn P. Dunnigan

Reviewed and Approved by:

Roland B. Phillips

Attachments

cc: B. S. Ellis, Syracuse, N. Y.
Henry W. Davis, Penn Yan, N. Y.
Jesse S. Wicks, Little Valley, N. Y.
H. M. Kautz, Upper Darby, Pa.

$\gamma_m = 130\ ^{\#}/FT^3 = 2.08 \times 62.4\ ^{\#}/FT^3$

$\gamma_s = 140.5\ ^{\#}/FT^3 = 2.24 \times 62.4\ ^{\#}/FT^3$

$\gamma_b = 78\ ^{\#}/FT^3 = 1.25 \times 62.4\ ^{\#}/FT^3$

$\phi = 21.5°$ $\tan\phi = .394$

$C = 300\ ^{\#}/FT^2$

$L = 238.24'$

$$F.S. = \frac{L.C. + \Sigma N (\tan\phi)(62.4\ ^{\#}/FT^3)}{\Sigma T (62.4)} = \frac{\text{Resisting Forces}}{\text{Driving Forces}} = \frac{189470}{133286} = 1.42$$

$L.C. = 238.24 \times 300\ ^{\#}/FT^2 = 71472.0$

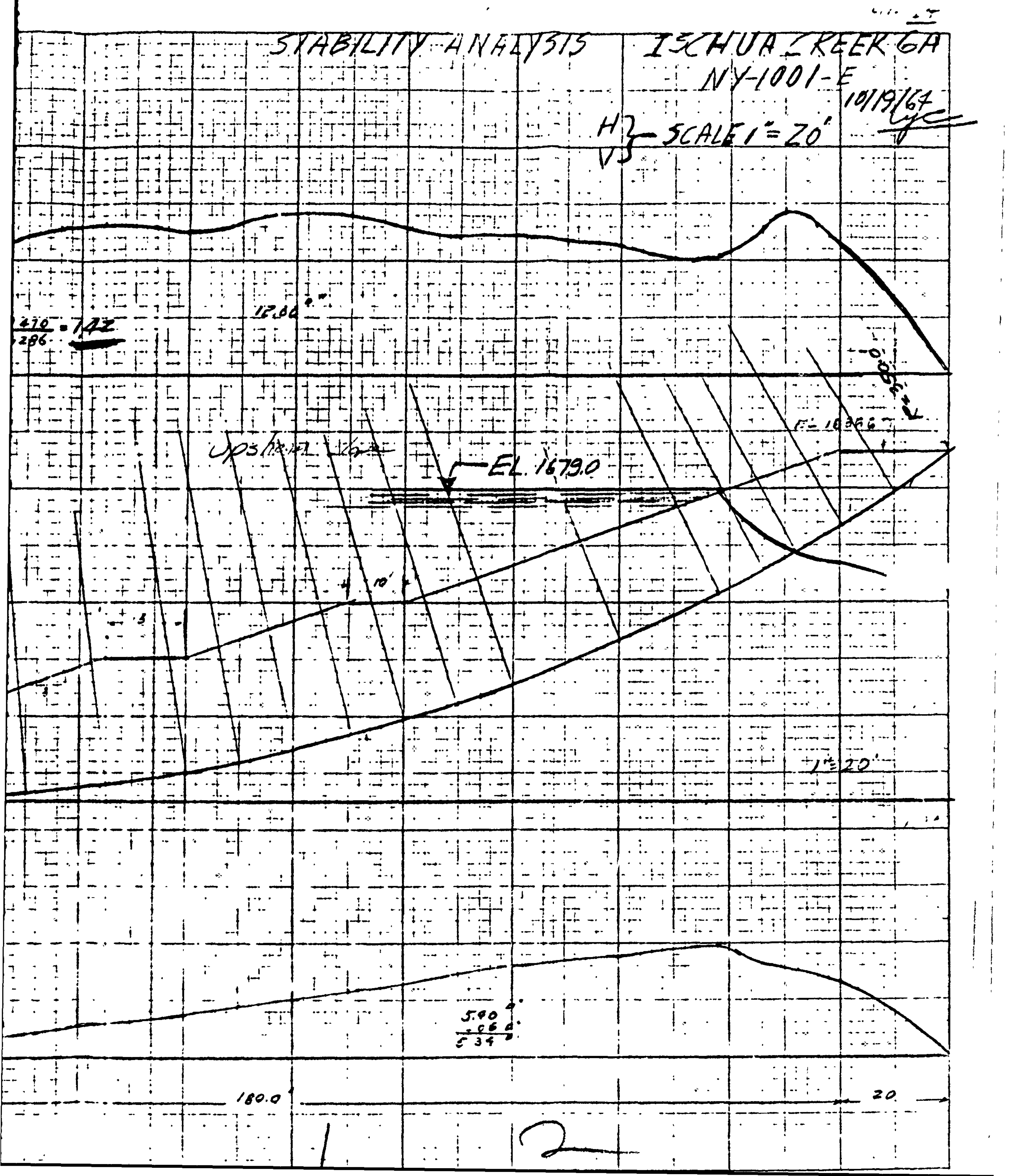
$\Sigma N(\tan\phi)(62.4) = 12° \times 400 \times .394 \times 62.4 = 117998.0$

189470.0

$\Sigma T(62.4) = 534 \times 62.4 = 133286.0$

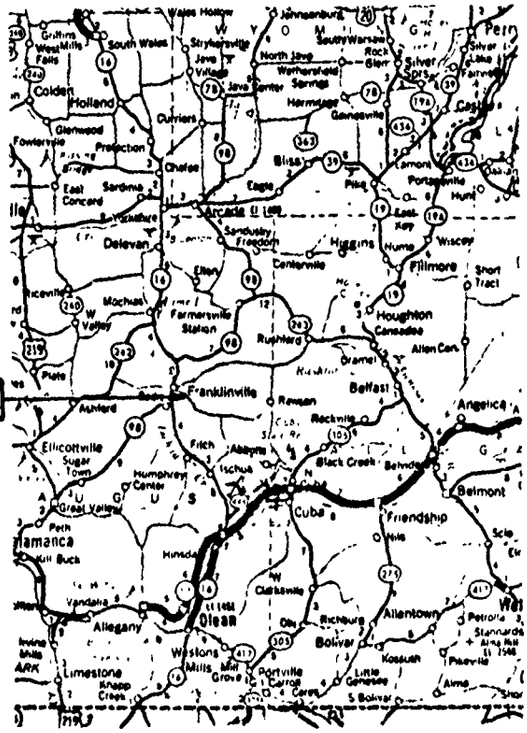
$F.S. = 1.42$

006°

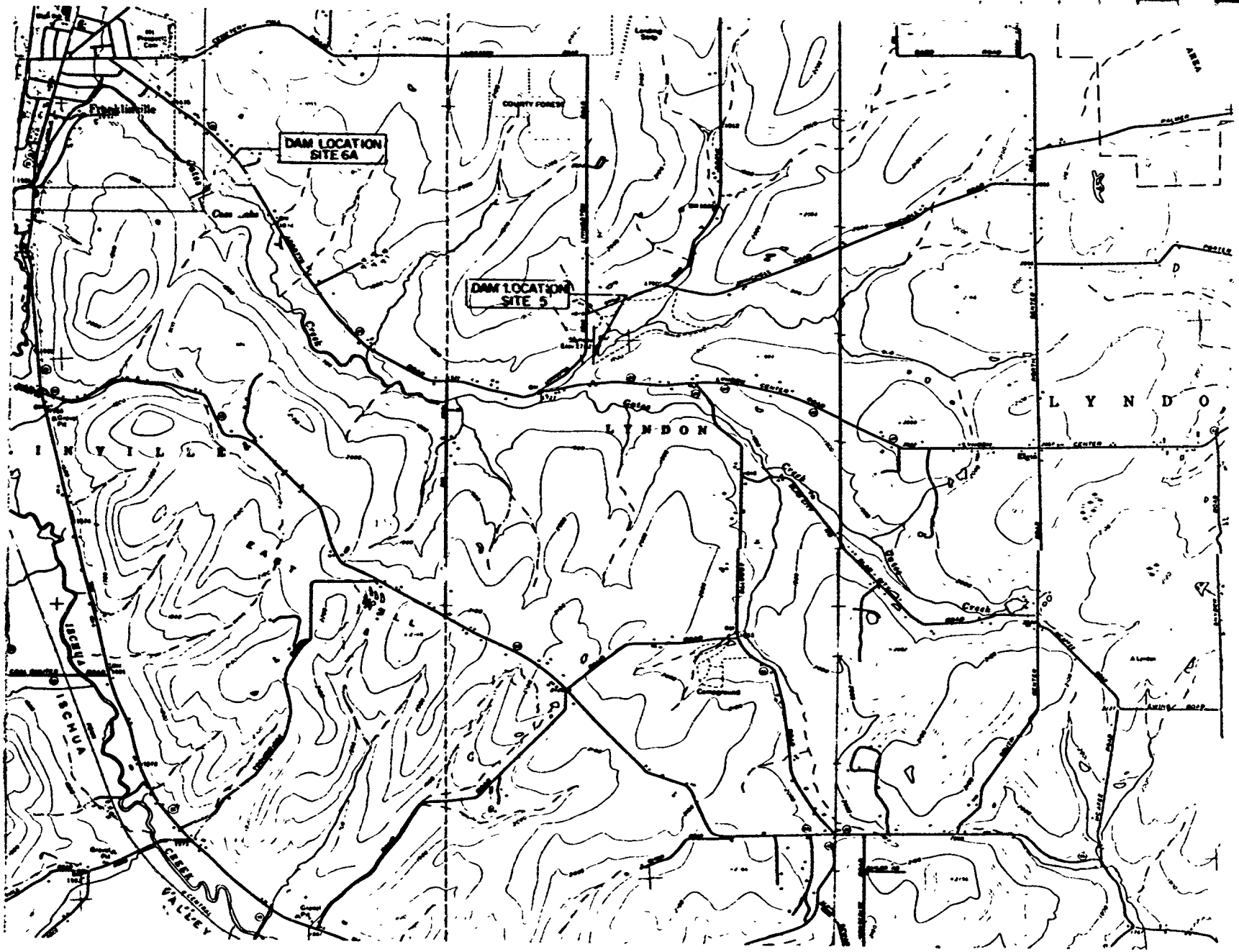

STABILITY ANALYSIS ISCHUA CREEK GA
NY-1001-E
10/19/64
H V SCALE 1" = 20'
470 / 286 = 1.42
EL. 1679.0
Upstream Slope
10'
1" = 20'
5.90
.06
5.34
180.0
20
1
2

APPENDIX E

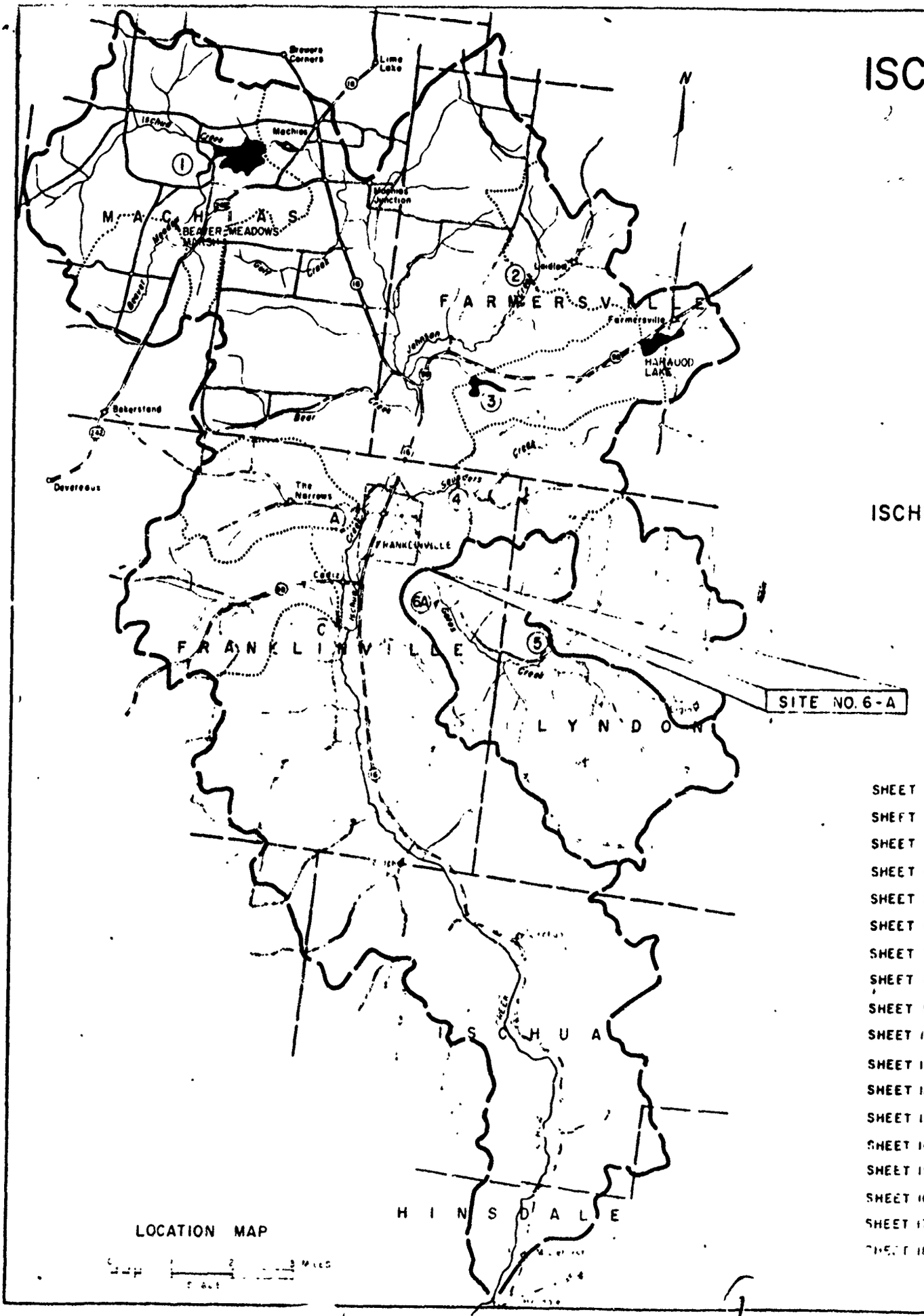
DRAWINGS



VICINITY MAP
ISCHUA CREEK WATERSHED PROJECT
SITE 6A
I.D. NO. N.Y. 571



TOPOGRAPHIC MAP
ISCHUA CREEK WATERSHED PROJECT
SITE 6A
I.D. NO. N.Y. 571



ISCHUA (
MULT

DRAINAGE

FLOOD S
TO EMERGENCY

WATER S
AT RECREATIC

HEIGHT C

VOLUME (

BUILT U

ISCHUA CREEK

NEW

SHEET 1 COVER SHEET
SHEET 2 PLAN OF STOR
SHEET 3 PLAN OF DAMS
SHEET 4 PROFILES
SHEET 5 PROFILES
SHEET 6 DRAINAGE DET
SHEET 7 SEEPAGE DRAI
SHEET 8&8A PLAN-PROFILE
SHEET 9 RISER DETAIL
SHEET 10 RISER - REINF
SHEET 11 RISER - REINF
SHEET 12 CRADLE, COLL
SHEET 13 IMPACT BASIN
SHEET 14 MISC DETAILS
SHEET 15 TRASH RACK
SHEET 16 TEST HOLE DE
SHEET 17 TEST HOLE DE
SHEET 18 FENCING DETAIL

ISCHUA CREEK WATERSHED PROJECT

MULTIPLE - PURPOSE DAM NO. 6 - A

GATES CREEK

DRAINAGE AREA	8,064	Acres
FLOOD STORAGE TO EMERGENCY SPILLWAY CREST	2,265	Ac. Ft.
WATER SURFACE AREA AT RECREATION POOL	80	Acres
HEIGHT OF DAM	62	Feet
VOLUME OF FILL	~~296,700~~ 298,821	Cubic Yards

BUILT UNDER THE WATERSHED PROTECTION AND FLOOD PREVENTION ACT

by

ISCHUA CREEK COUNTY SMALL WATERSHED PROTECTION DISTRICT

with the assistance of

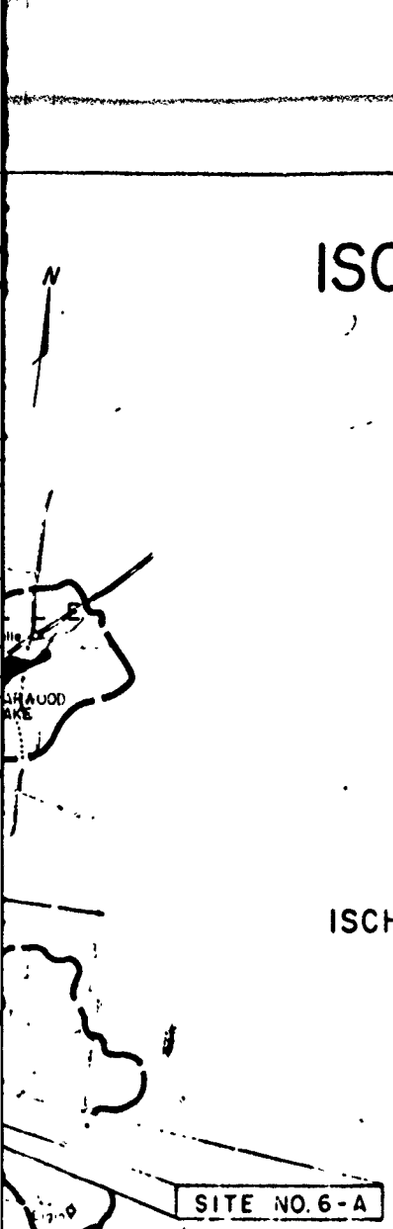
NEW YORK STATE CONSERVATION DEPARTMENT

and the

SOIL CONSERVATION SERVICE

of the

U.S. DEPARTMENT OF AGRICULTURE



SHEET 1 COVER SHEET
SHEET 2 PLAN OF STORAGE AREAS
SHEET 3 PLAN OF DAMSITE
SHEET 4 PROFILES
SHEET 5 PROFILES
SHEET 6 DRAINAGE DETAILS
SHEET 7 SEEPAGE DRAIN OUTLET DETAILS - TYP SECT DAM
SHEET 8&8A PLAN-PROFILE OF PRINCIPAL SPILLWAY
SHEET 9 RISER DETAILS
SHEET 10 RISER - REINF STEEL DETAILS
SHEET 11 RISER - REINF STEEL DETAILS
SHEET 12 CRADLE, COLLARS & POND DRAIN INLET
SHEET 13 IMPACT BASIN DETAILS
SHEET 14 MISC DETAILS & STEEL SCHEDULE
SHEET 15 TRASH RACK & GATE HOIST PLATFORM DETAILS
SHEET 16 TEST HOLE DESCRIPTIONS
SHEET 17 TEST HOLE DESCRIPTIONS
SHEET 18 FENCING DETAILS

AS BUILT

5/17/71

DATE	ITEM	APP'D
FEB 1967	SHEETS 2,3,4,5,6,7,8,8A	
FEB 1966	SHEETS 9,10,11,12,13,14,15,16,17,18	

REVISIONS

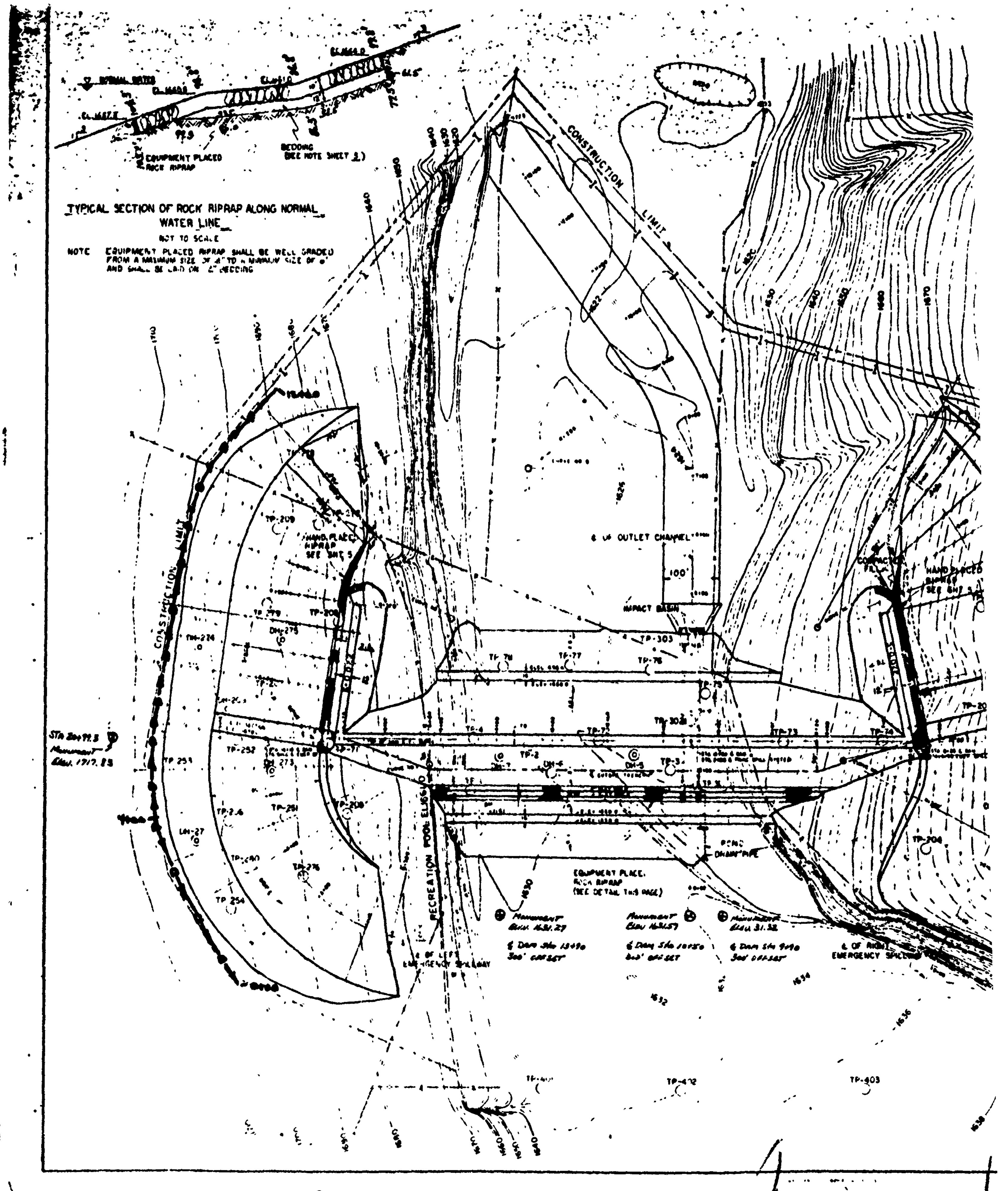
ISCHUA CREEK WATERSHED PROJECT
MULTIPLE - PURPOSE DAM NO. 6 - A
CATTARAUGUS COUNTY, NEW YORK
COVER SHEET
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

HEAD OF E & WP UNIT

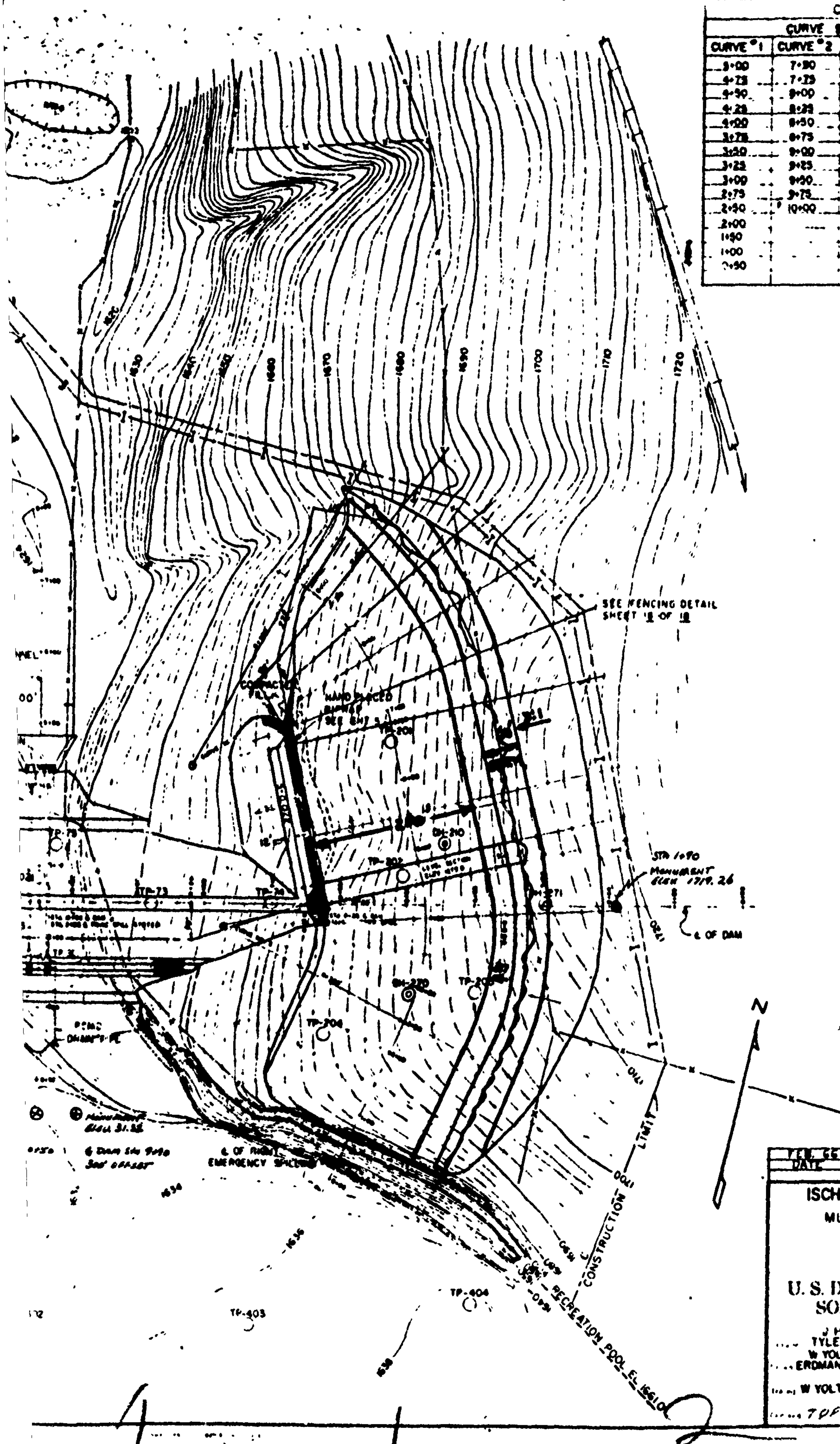
STATE CONSERVATION ENG'R

M. N. FOLWICH

NY-1001-P



NORMAL WATER
EQUIPMENT PLACED ROCK RIPRAP
BEDDING (SEE NOTE SHEET 3)
TYPICAL SECTION OF ROCK RIPRAP ALONG NORMAL WATER LINE
NOT TO SCALE
NOTE: EQUIPMENT PLACED RIPRAP SHALL BE WELL GRADED FROM A MAXIMUM SIZE OF 18" TO A MINIMUM SIZE OF 6" AND SHALL BE LAID ON 12" BEDDING
CONSTRUCTION LIMIT
HAND PLACED RIPRAP SEE SHT 5
℄ OF OUTLET CHANNEL
100'
IMPACT BASIN
TP-303
TP-209
TP-208
DH-275
DH-274
TP-252
TP-253
TP-251
TP-254
TP-276
DH-273
COMPACTED FILL
RECREATION POOL EL1630.0
EQUIPMENT PLACE. ROCK RIPRAP (SEE DETAIL THIS PAGE)
POND DRAIN PIPE
Monument Elev. 1631.27
Monument Elev. 1631.57
Monument Elev. 1631.32
STA 20+99.5 Monument Elev. 1717.23
℄ Dam Sta 13+90 300' OFFSET
℄ Dam Sta 10+50 300' OFFSET
℄ Dam Sta 9+90 300' OFFSET
℄ OF LEFT EMERGENCY SPILLWAY
℄ OF RIGHT EMERGENCY SPILLWAY
TP-402
TP-403



CURVE DATA

CURVE STATIONING				DEFL. ∠	CHORD DISTANCE
CURVE #1	CURVE #2	CURVE #3	CURVE #4		
5+00	7+50	4+50	6+80	0	0
4+75	7+75	4+25	7+05	2°2x'	25.0
4+50	8+00	4+00	7+30	4°47'	50.0
4+25	8+25	3+75	7+55	7°10'	74.9
4+00	8+50	3+50	7+80	9°33'	99.8
3+75	8+75	3+25	8+05	11°56'	124.1
3+50	9+00	3+00	8+30	14°18'	148.4
3+25	9+25	2+75	8+55	16°53'	172.6
3+00	9+50	2+50	8+80	19°05'	196.2
2+75	9+75		9+05	21°29'	219.7
2+50	10+00			23°52'	242.8
2+00				28°39'	287.7
1+50				33°25'	330.4
1+00				38°12'	371.1
0+50				42°58'	408.9

CURVE # 5		
PC 7+12.5	0	0
7+62.5	4°51'	49.9
8+12.5	9°42'	99.4
8+62.5	14°33'	148.2
PT 9+00.0	18°12'	184.3

LEGEND

- NEW FENCE
- EXISTING FENCE
- CONSTRUCTION LIMIT
- RECREATION POOL
- ℄ OF STREAM
- 1700 CONTOUR
- OUTLINE OF SINK AREA

AS BUILT

0 50 100 200
SCALE IN FEET
2' CONTOUR INTERVAL

5/19/71

FEB. 66	DIKING & RIPRAP	
DATE	ITEM	APP'D

REVISIONS

ISCHUA CREEK WATERSHED PROJECT

MULTIPLE - PURPOSE DAM NO 6 - A

CATTARAUGUS COUNTY, NEW YORK

PLAN OF DAM SITE

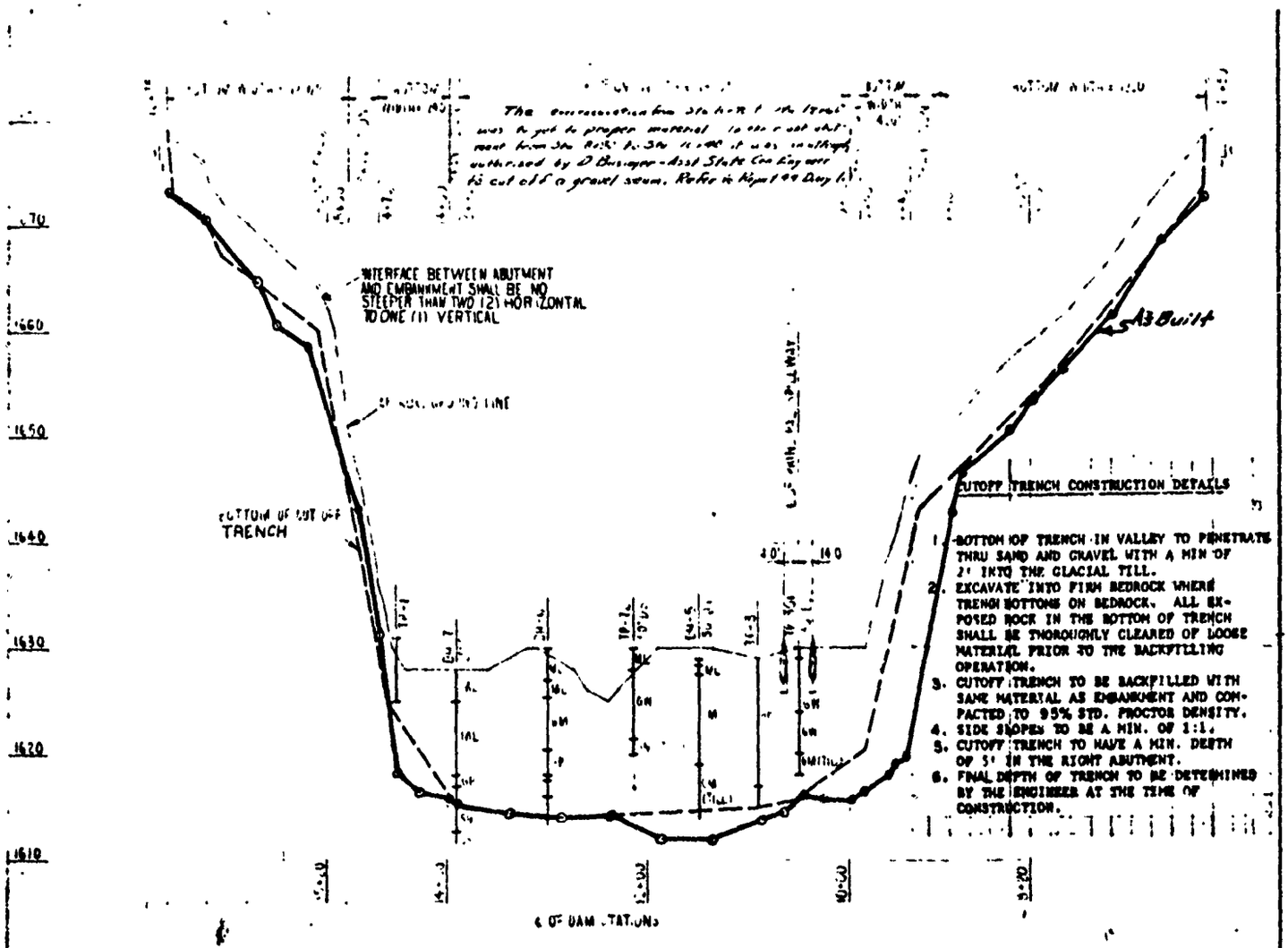
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

J HARRINGTON
TYLER-HUBBARD 12-63
W YOLTON
ERDMANN-THOMA 63-64
W YOLTON 4-64
TDF 4-65

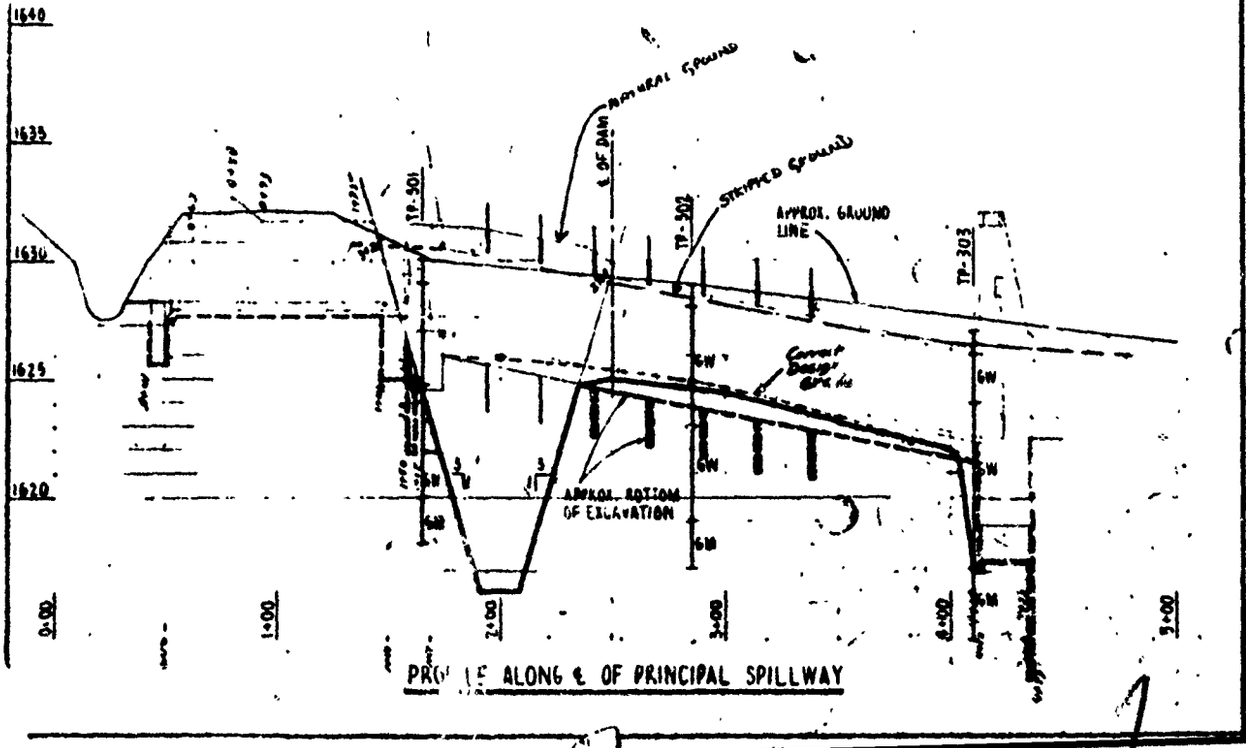
3 of 18

NY-1001 - P

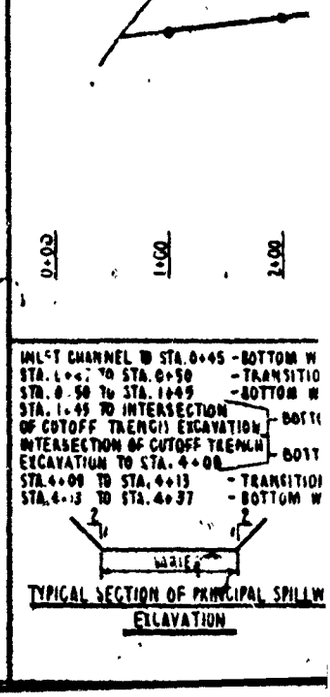
③



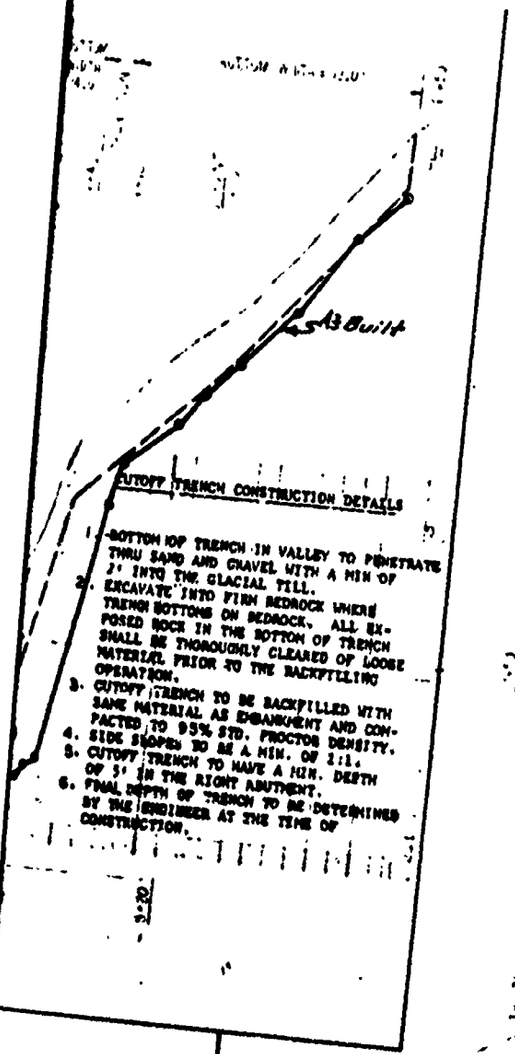
PROFILE ALONG ℄ OF CUT-OFF TRENCH



PROFILE ALONG ℄ OF PRINCIPAL SPILLWAY

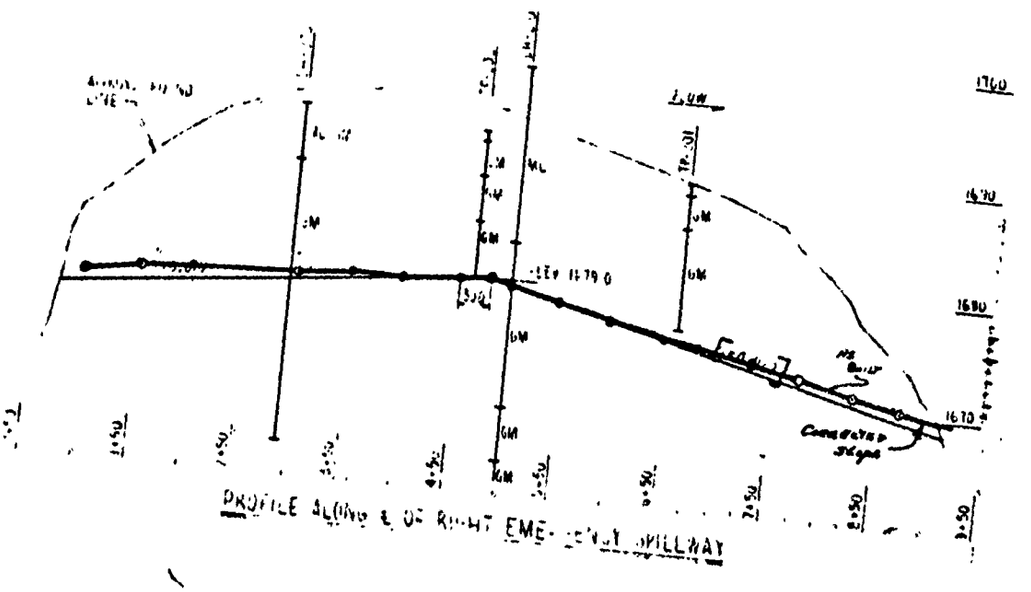


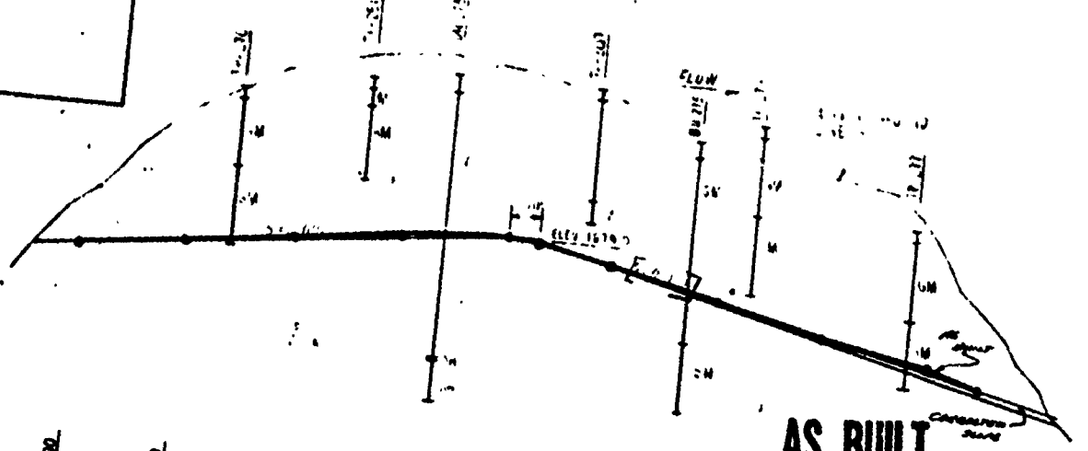
TYPICAL SECTION OF PRINCIPAL SPILLW
EXCAVATION



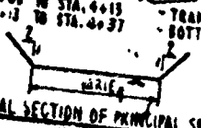
CUTOFF TRENCH CONSTRUCTION DETAILS

1. BOTTOM OF TRENCH IN VALLEY TO PENETRATE THRU SAND AND GRAVEL WITH A MIN OF 2' INTO THE GLACIAL TILL.
2. EXCAVATE INTO FIRM BEDROCK WHERE TRENCH BOTTOMS ON BEDROCK. ALL EXPOSED ROCK IN THE BOTTOM OF TRENCH SHALL BE THOROUGHLY CLEARED OF LOOSE MATERIAL PRIOR TO THE BACKFILLING OPERATION.
3. CUTOFF TRENCH TO BE BACKFILLED WITH SAME MATERIAL AS EMBANKMENT AND COMPACTED TO 95% STD. PROCTOR DENSITY.
4. SIDE SLOPES TO BE A MIN. OF 1:1.
5. CUTOFF TRENCH TO HAVE A MIN. DEPTH OF 5' IN THE RIGHT ABUTMENT.
6. FINAL DEPTH OF TRENCH TO BE DETERMINED BY THE ENGINEER AT THE TIME OF CONSTRUCTION.



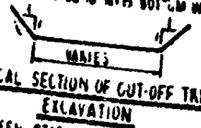


INLET CHANNEL TO STA 0+45 - BOTTOM WIDTH = 16.0'
STA. 0+45 TO STA. 0+50 - TRANSITION
STA. 0+50 TO STA. 1+45 - BOTTOM WIDTH = 18.0'
STA. 1+45 TO INTERSECTION OF CUTOFF TRENCH EXCAVATION - BOTTOM WIDTH = 42'
INTERSECTION OF CUTOFF TRENCH EXCAVATION TO STA. 4+08 - BOTTOM WIDTH = 42'
STA. 4+08 TO STA. 4+13 - TRANSITION
STA. 4+13 TO STA. 4+37 - BOTTOM WIDTH = 64.5'



TYPICAL SECTION OF PRINCIPAL SPILLWAY EXCAVATION

STA 6+50 TO 9+40 BOTTOM WIDTH = 12.0'
STA 9+40 TO 9+60 TRANSITION
STA 9+60 TO 10+00 BOTTOM WIDTH = 28.0'
STA 10+00 TO 14+00 TRANSITION
STA 14+00 TO 14+30 BOTTOM WIDTH = 28.0'
STA 14+30 TO 15+00 TRANSITION
STA 15+00 TO 16+35 BOTTOM WIDTH = 12.0'



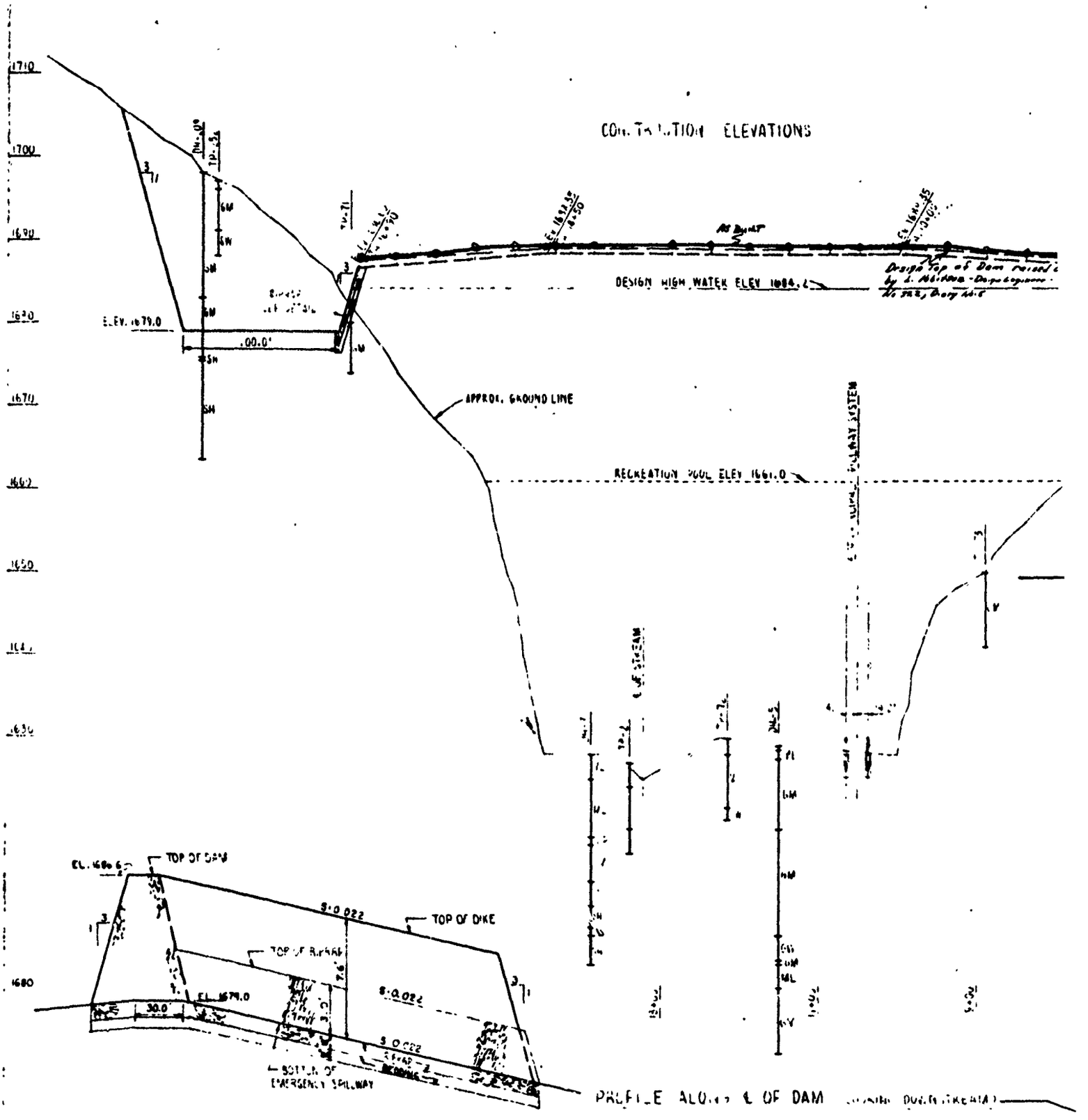
TYPICAL SECTION OF CUT-OFF TRENCH EXCAVATION
BETWEEN STATIONS 10+90 & 16+10
SIDE SLOPES ON CUTOFF TRENCH ARE 1:1

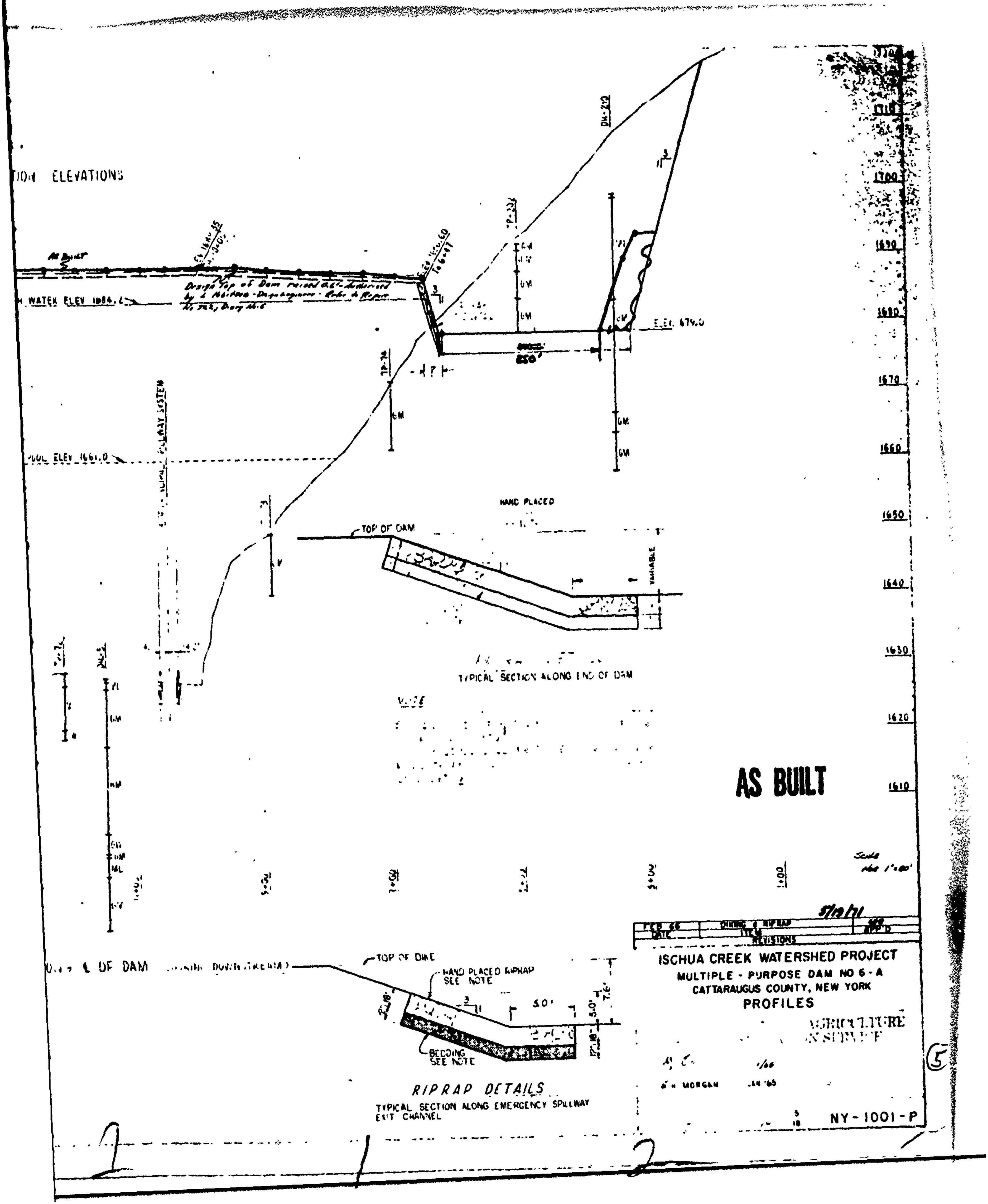
ISCHUA CREEK WATERSHED PROJECT
MULTIPLE - PURPOSE DAM NO 6 - A
CATTARAUGUS COUNTY, NEW YORK
PROFILES
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

W.H. MORGAN JAN '68

4

NY - 1001 - P


CONSTRUCTION ELEVATIONS
DESIGN HIGH WATER ELEV 1684.2
APPROX. GROUND LINE
RECREATION POOL ELEV 1661.0
ELEV. 1679.0
100.0'
TOP OF DAM
TOP OF DIKE
TOP OF RIPRAP
EL. 1679.0
30.0
BOTTOM OF EMERGENCY SPILLWAY
PROFILE ALONG ℄ OF DAM
TYPICAL SECTION OF DIKING



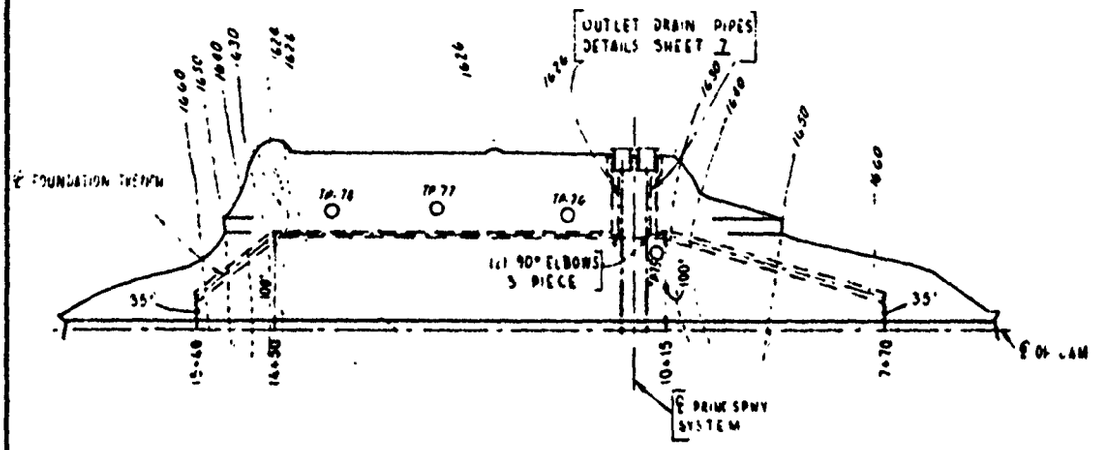
ELEVATIONS
AS BUILT
WATER ELEV 1684.2
POOL ELEV 1661.0
ELEV 1679.0
250'
GM
TOP OF DAM
HAND PLACED
VARIABLE
TYPICAL SECTION ALONG END OF DAM
TOP OF DIKE
HAND PLACED RIPRAP SEE NOTE
5.0'
7.6'
BEDDING SEE NOTE
RIPRAP DETAILS
TYPICAL SECTION ALONG EMERGENCY SPILLWAY EXIT CHANNEL
1710
1700
1690
1680
1670
1660
1650
1640
1630
1620
1610
FEB 66
DIKING & RIPRAP
DATE
ITEM
REVISIONS
ISCHUA CREEK WATERSHED PROJECT
MULTIPLE - PURPOSE DAM NO 6 - A
CATTARAUGUS COUNTY, NEW YORK
PROFILES
NY-1001-P

SUMMARY OF QUANTITIES

- 486 C.Y. OF ① FILTER MATERIAL AND BEDDING
- 100 C.Y. OF ② GRAVELLY MATERIAL
- 554 FT OF 10" DIA PIPE
- 6 3 PIECE 90° ELBOWS 10" DIA PIPE
- 4 45° ELBOWS 10" DIA PIPE
- 4 METAL END CAPS

NOTES

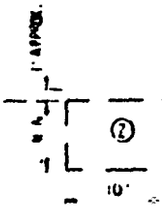
1. THE DRAINAGE PIPES SHALL BE 10" DIA PERFORATED HELICAL OR ANNULAR 16 GAGE BITU COATED CORRU METAL PIPE WITH STANDARD COUPLING BANDS
2. PERFORATIONS SHALL BE ½" DIA & PLACED ON THE LOWER SIDE OF THE PIPE.



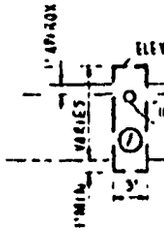
PLAN OF DRAINAGE SYSTEM

0 50 100 200 FEET

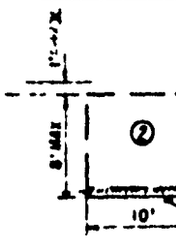
SCALE



STA. 7+70 TO 10+15



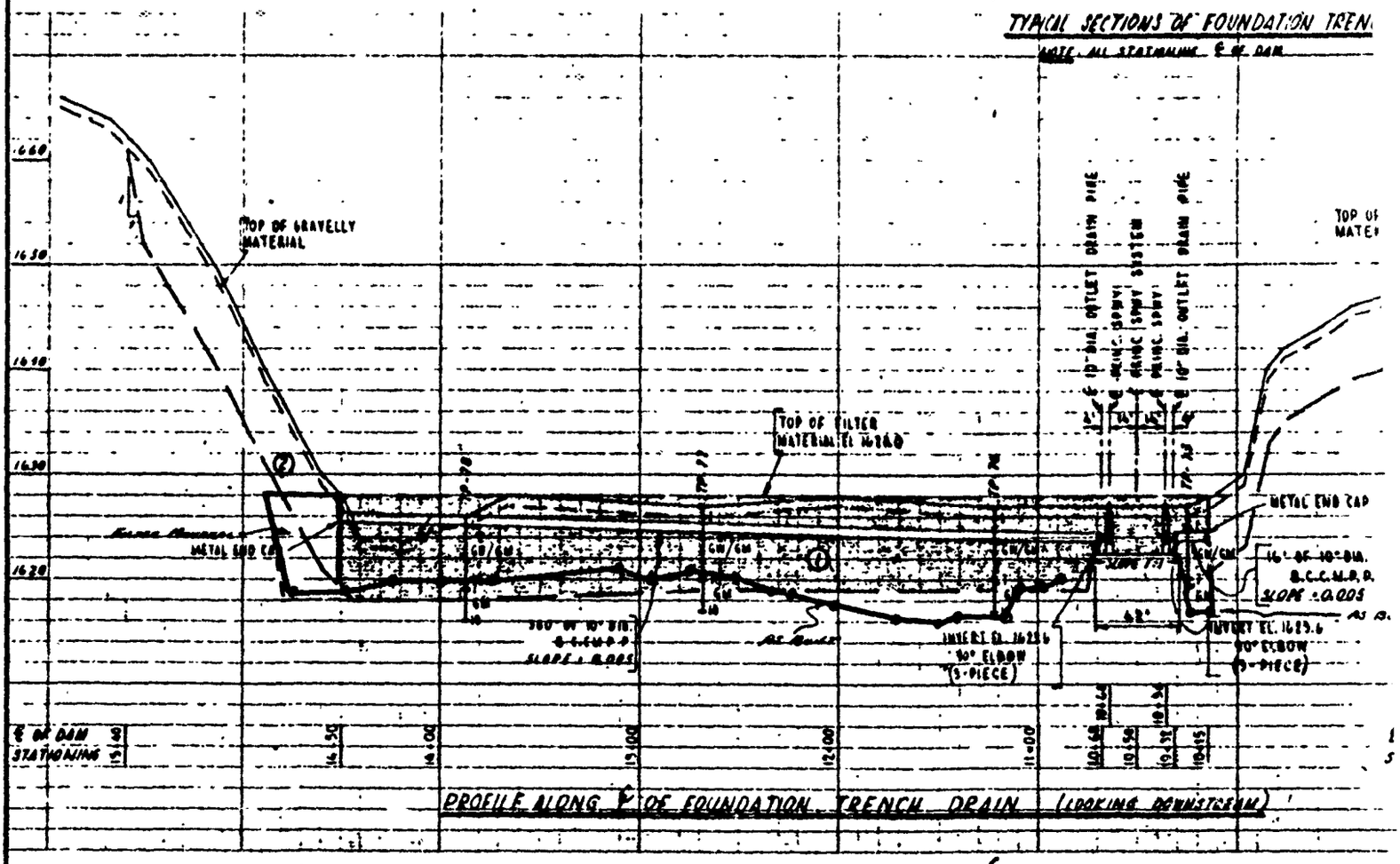
STA. 10+15 TO 14+50



STA. 14+50 TO 15+40

TYPICAL SECTIONS OF FOUNDATION TRENCH

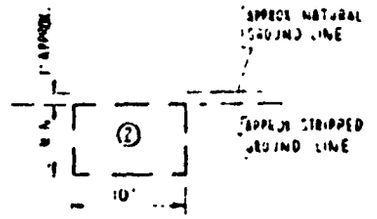
NOTE: ALL STATIONING ℄ OF DAM



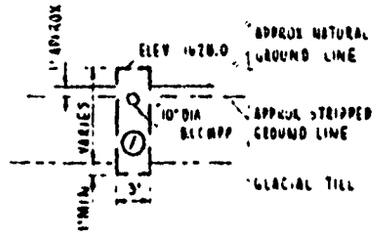
PROFILE ALONG ℄ OF FOUNDATION TRENCH DRAIN (LOOKING DOWNSTREAM)

TED HELICAL
METAL PIPE

ED ON THE

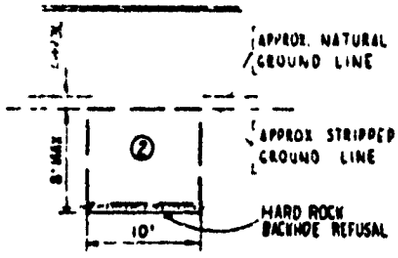


STA. 7+70 TO 10+15

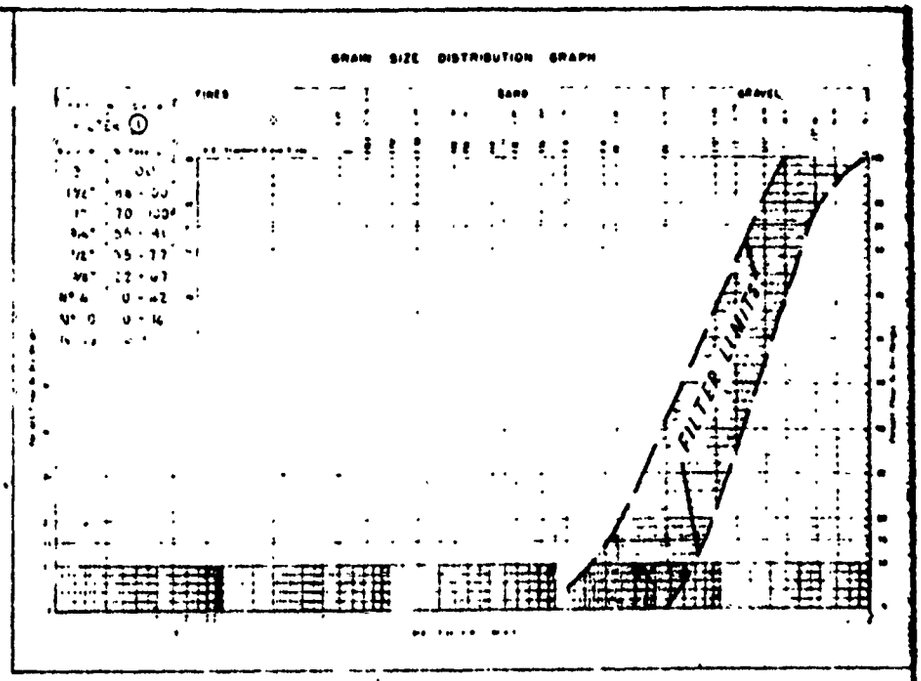


℄ OF DAM

STA. 10+15 TO 16+50



STA 16+50 TO 19+40

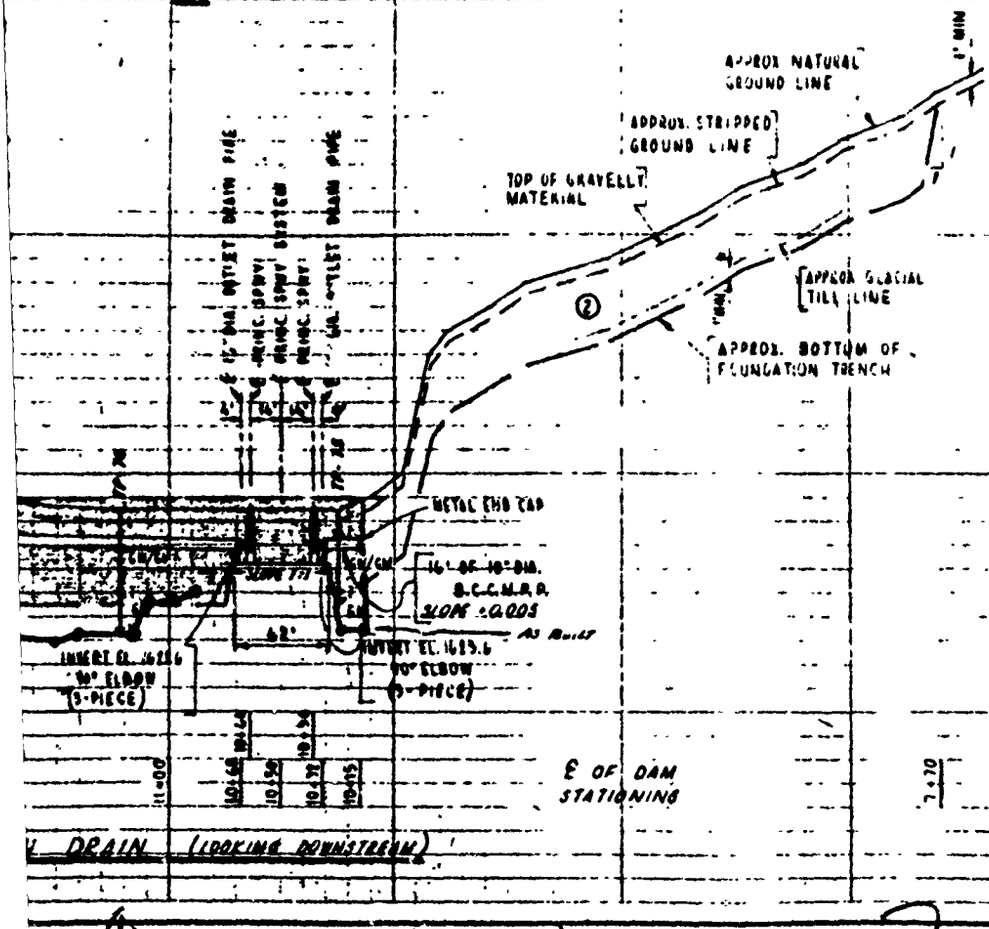


① DESIGNED FILTER SEE GRAIN SIZE DISTRIBUTION GRAPH

② GRAVELLY MATERIAL (GW/GM) SIMILAR TO THAT FOUND FROM 1' TO 7' IN TP 78

TYPICAL SECTIONS OF FOUNDATION TRENCH

NOTE: ALL STATIONING ℄ OF DAM



AS BUILT

NOTE:
THE PROFILES OF THE BOTTOM OF ALL EXCAVATIONS AS SHOWN ARE ONLY APPROXIMATE THE REQUIRED FINISHED GRADES WILL BE ESTABLISHED BY THE ENGINEER AT THE TIME OF CONSTRUCTION

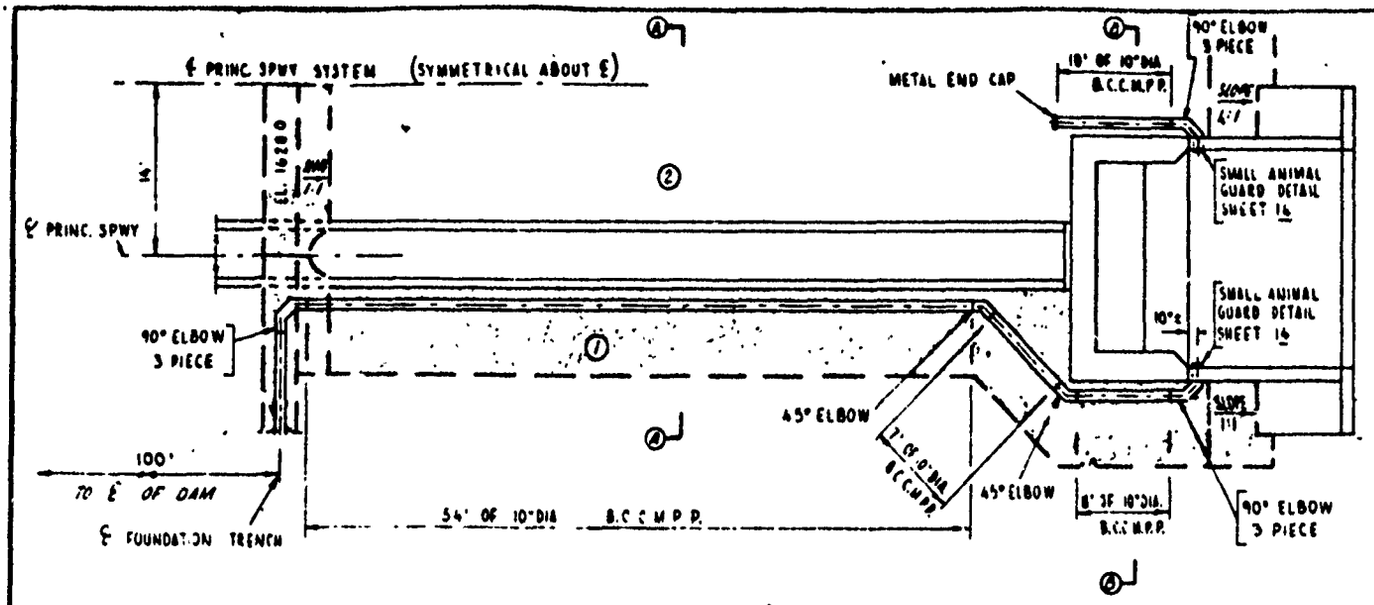
Elahi

ISCHUA CREEK WATERSHED PROJECT
MULTIPLE - PURPOSE DAM NO. 6 - A
CATTARAUGUS COUNTY, NEW YORK
DRAINAGE DETAILS

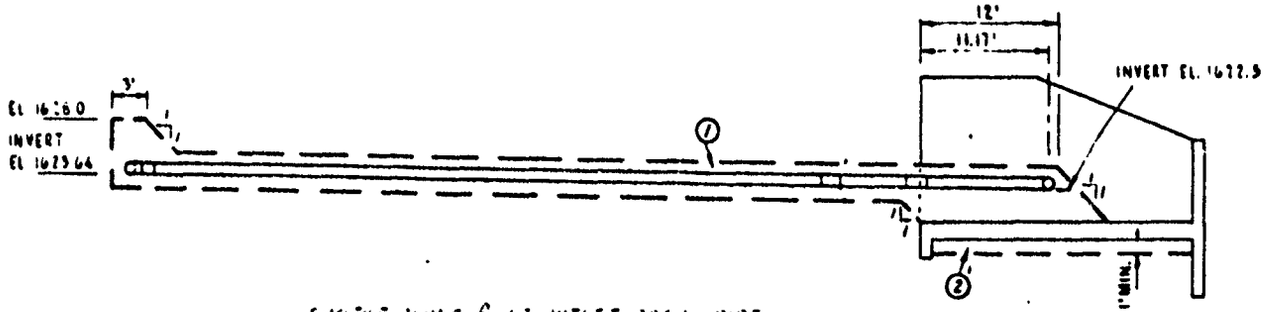
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed TOP	Date 1/65	Approved by	
Drawn H T. BROWNING JR.	Date 3/65	Title	
Traced		Title	
Checked BJG.	Date 4/65	Sheet No. 6 of 10 sheets	Drawing No. NY-1001-P

(6)

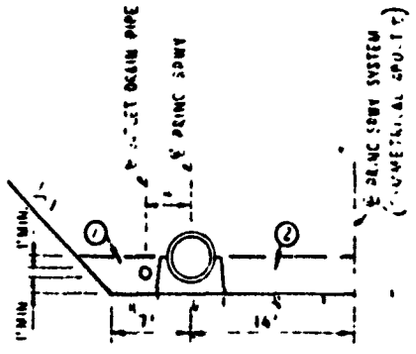


PLAN OF OUTLET DRAIN

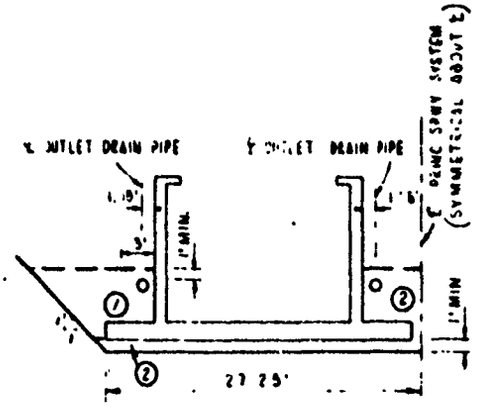


ENGOLE ALONG ℄ OF OUTLET DRAIN PIPE

NOTE.
DRAIN FILL UNDER BASE OF THE IMPACT B
WILL BE COMPACTED BY MANUALLY DIRECTED
TAMPERS

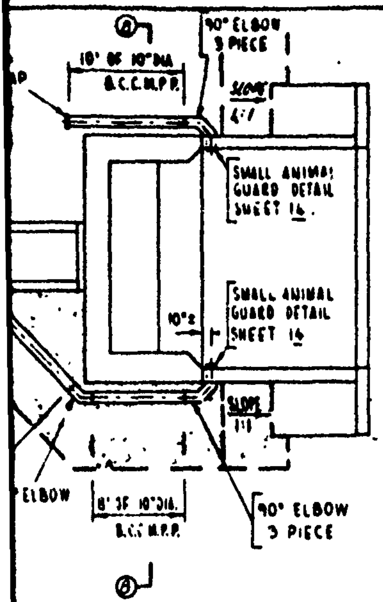


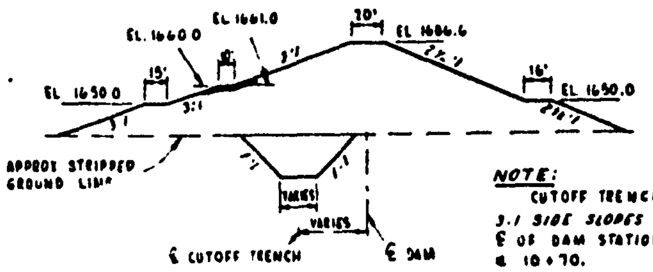
SECTION AA



SECTION BB

DETAILS OF OUTLET DRAIN



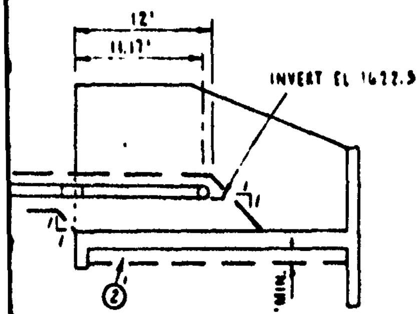


NOTE:
CUTOFF TRENCH TO HAVE 3:1 SIDE SLOPES BETWEEN ℄ OF DAM STATIONS 10+50 & 10+70.

TYPICAL SECTION OF DAM

NOT TO SCALE

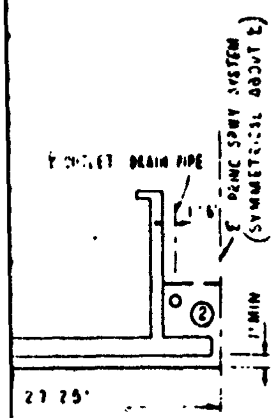
CLASS B-2 COMPACTION, BORROW FROM EMERGENCY SPILLWAY.



NOTE
DRAIN FILL UNDER BASE OF THE IMPACT BASIN WILL BE COMPACTED BY MANUALLY DIRECTED POWER TAMPERS

(1) DESIGNED FILTER, SEE SHEET 6 FOR GRADATION

(2) GRAVELLY MATERIAL (GW/ GM) SIMILAR TO THAT FOUND FROM 1' TO 7' DEEP IN TP 7B



TION BB

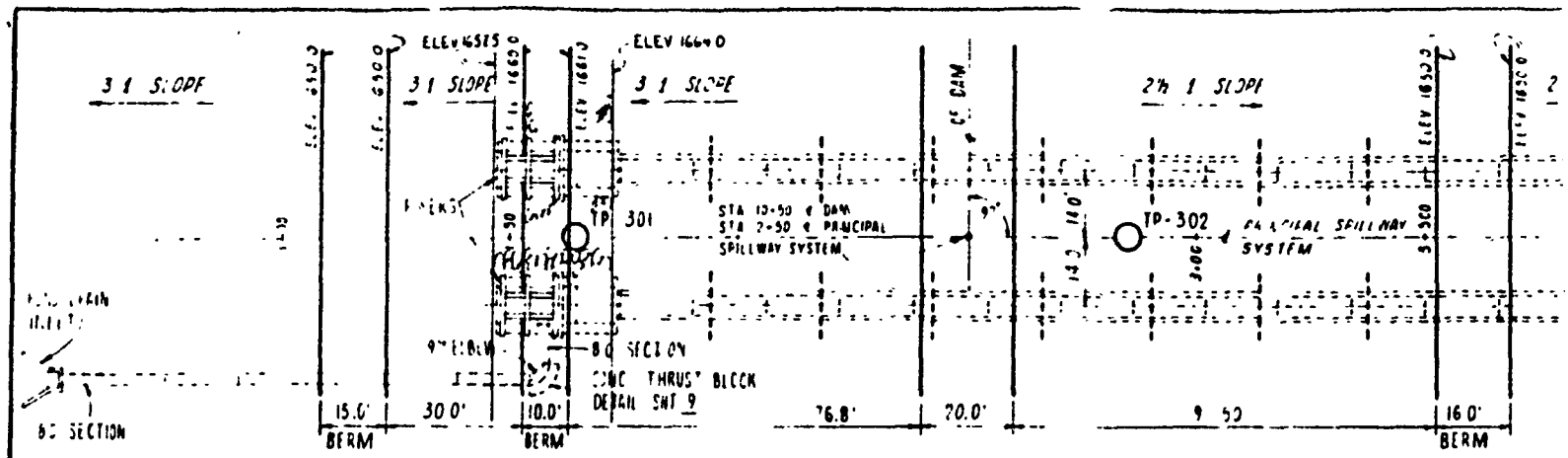
AS BUILT

5/19/71

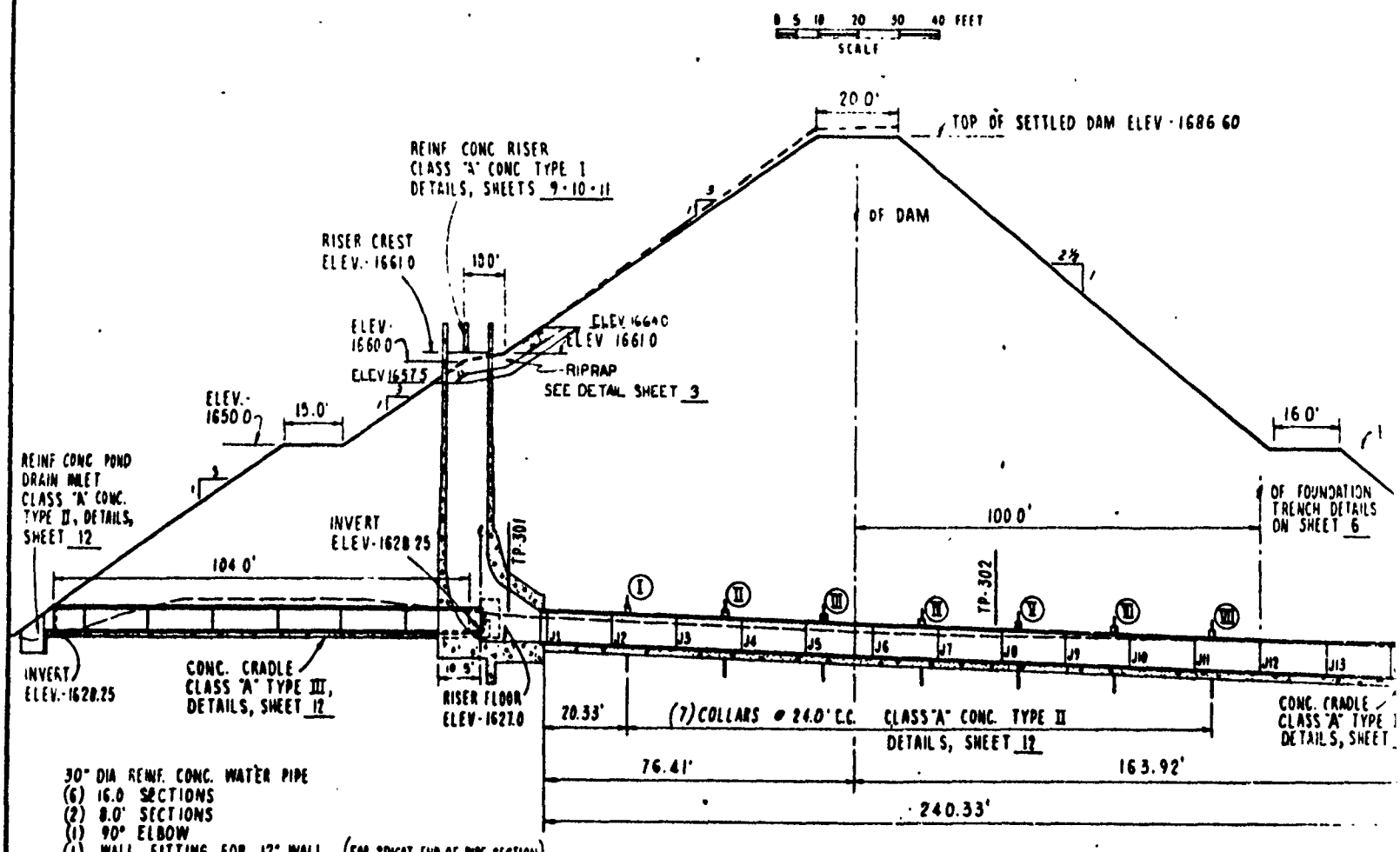
ISCHUA CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO 6-A
CATTARAUGUS COUNTY, NEW YORK
SEEPAGE DRAIN OUTLET DETAILS · TYP. SECT DAM

U.S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed TSP		
Drawn J. T. BRUNING JR.	JAN 65	
Checked BJG	JAN 65	Sheet 7 of 8 · Drawing No. NY-1001-P



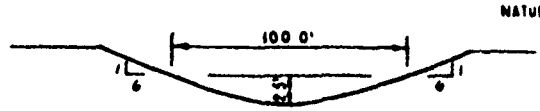
PLAN



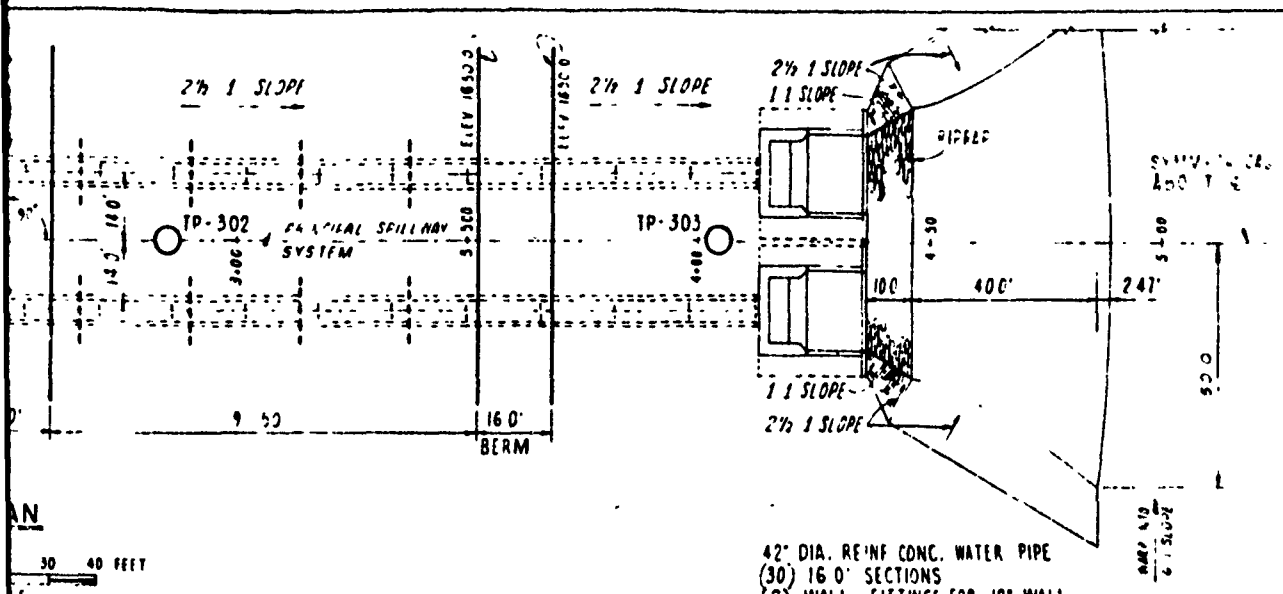
30" DIA REINF. CONC. WATER PIPE
(6) 16.0 SECTIONS
(2) 8.0' SECTIONS
(1) 90° ELBOW
(1) WALL FITTING FOR 12" WALL (FOR SPIGOT END OF PIPE SECTION)

TOTAL LENGTH · 117.79'
PRESSURE HEAD · 29.50'
LOAD · 21940. LBS. PER LIN. FT BASED ON O.D. OF 2.96'. MIN. 3 EDGE BEARING STRENGTH FOR 0.001" CRACK · 4670 LBS. PER LIN. FT. FOR PRESTRESSED PIPE AWWA · C301.

PROFILE ALONG ℄ OF PRINCIPAL SPILLWAY



TYPICAL SECTION OF OUTLET CHANNEL
FROM PRINC SPWY ℄ STA 4+88.7 TO INTERSECTION EXISITING STREAM



SAME LAYOUT FOR EACH PRINCIPAL SPILLWAY

JOINT	DISTANCE FROM RISER WALL	INVERT ELEV OF 42" DIA PIPE
J-1	0.33	1627.00
J-2	16.33	1626.98
J-3	32.33	1626.92
J-4	48.33	1626.82
J-5	64.33	1626.68
J-6	80.33	1626.50
J-7	96.33	1626.28
J-8	112.33	1626.02
J-9	128.33	1625.72
J-10	144.33	1625.38
J-11	160.33	1625.00
J-12	176.33	1624.58
J-13	192.33	1624.12
J-14	208.33	1623.62
J-15	224.33	1623.08
OUTLET	240.33	1622.50

NOTE:
ABOVE DIMENSIONS FOR LENGTHS OF PIPE ARE BASED ON NOMINAL LENGTHS AND DO NOT INCLUDE CREEP.

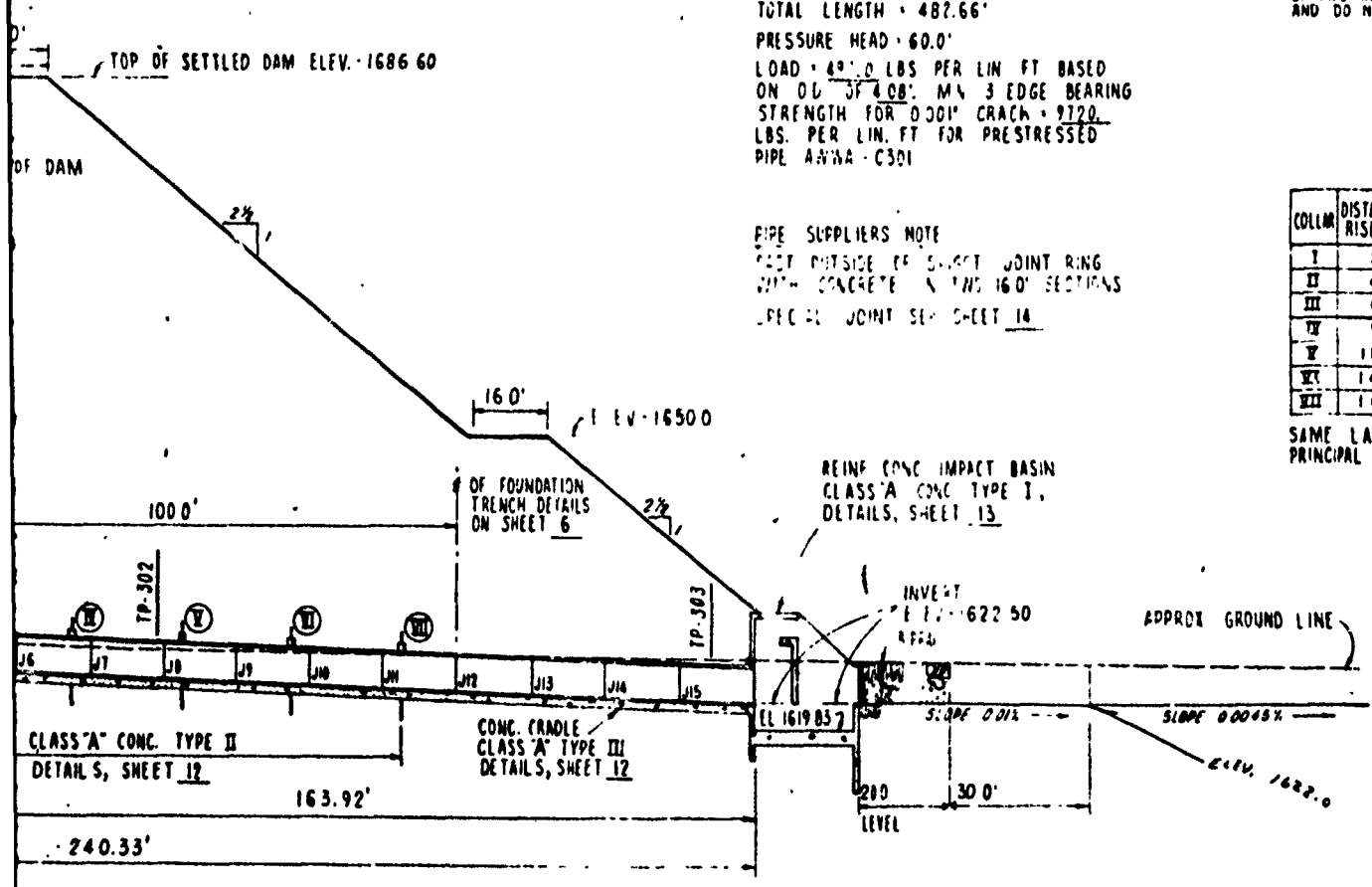
42" DIA. REINF CONC. WATER PIPE
(30) 16.0' SECTIONS
(2) WALL FITTINGS FOR 12" WALL

TOTAL LENGTH = 487.66'

PRESSURE HEAD = 60.0'

LOAD = 4[illegible].0 LBS PER LIN FT BASED ON OD OF 4.08', MIN 3 EDGE BEARING STRENGTH FOR 0.001" CRACK = 9720 LBS. PER LIN. FT FOR PRESTRESSED PIPE AWWA - C301

PIPE SUPPLIERS NOTE
[illegible] OUTSIDE OF SPIGOT JOINT RING WITH CONCRETE [illegible] 16.0' SECTIONS
SPECIAL JOINT SEE SHEET 14



COLLAR	DISTANCE FROM RISER WALL	INVERT ELEV. OF 42" DIA PIPE
I	20.33	1626.97
II	44.33	1626.85
III	68.33	1626.64
IV	92.33	1626.34
V	116.33	1625.95
VI	140.33	1625.47
VII	164.33	1624.90

SAME LAYOUT FOR EACH PRINCIPAL SPILLWAY.

AS BUILT

4/19/71

USE THIS SHEET FOR PIPE CONDUITS FURNISHED IN 16' SECTIONS

℄ OF PRINCIPAL SPILLWAY

0 5 10 20 FEET
VERT. SCALE

NATURAL GROUND LINE

100.0'

SECTION OF OUTLET CHANNEL
SPWY E STA 4+66.7 TO JUNCTION EXISTING STREAM

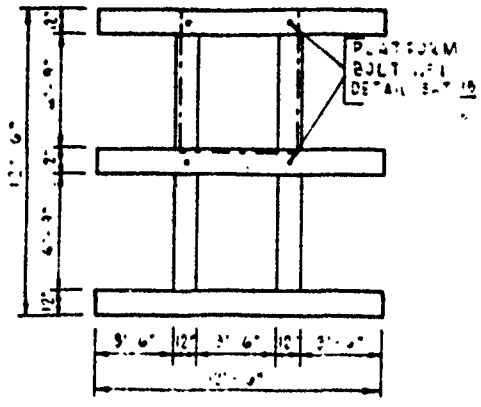
NOTE:
HANDPLACED RIPRAP IN THE OUTLET CHANNEL SHALL BE WELL GRADED FROM A MAX. SIZE OF 24" DIA. TO A MIN. SIZE OF 6" AND PLACED ON EDGE WITH THE LONGEST DIMENSION PERPENDICULAR TO THE LINE OF FLOW, AND SHALL BE LAID ON 12" OF BEDDING. BEDDING SHALL BE WITHIN THE LIMIT OF THE GRAIN SIZE DISTRIBUTION GRAPH ON SHEET 64.

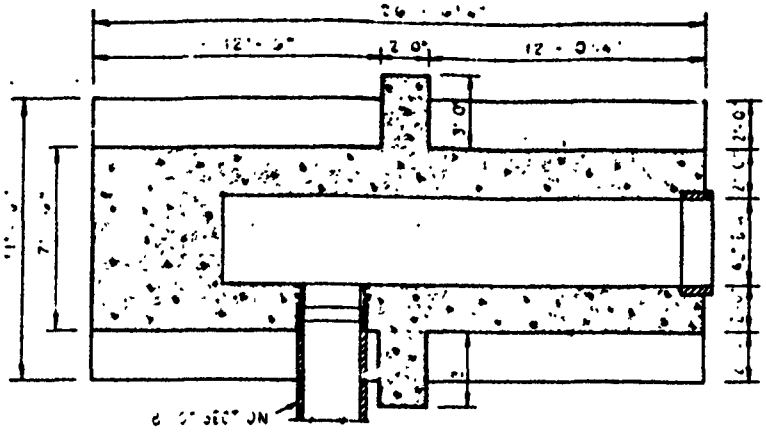
ISCHUA CREEK WATERSHED PROJECT
MULTIPLE - PURPOSE DAM NO. 6-A
CATTARAUGUS COUNTY, NEW YORK
PLAN - PROFILE OF PRINCIPAL SPILLWAY
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed
Drawn C B FORD JAN '68
Traced
Checked
Approved by
Title
Title
Sheet No. 8
Drawing No. NY - 1001 - P

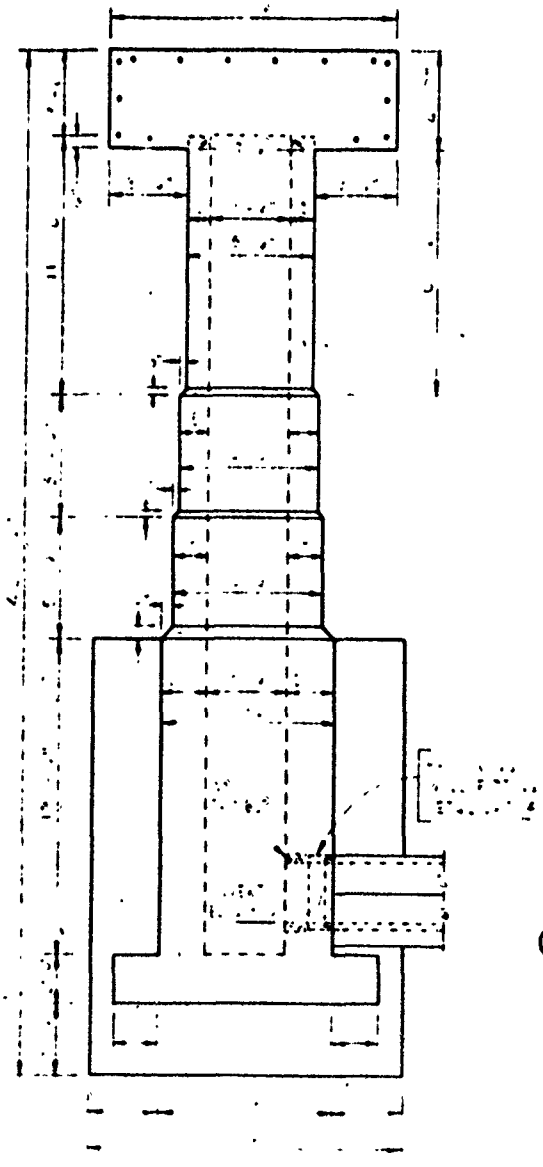
DATE	ITEM	APP'D
FEB 68	PIPE LENGTHS	

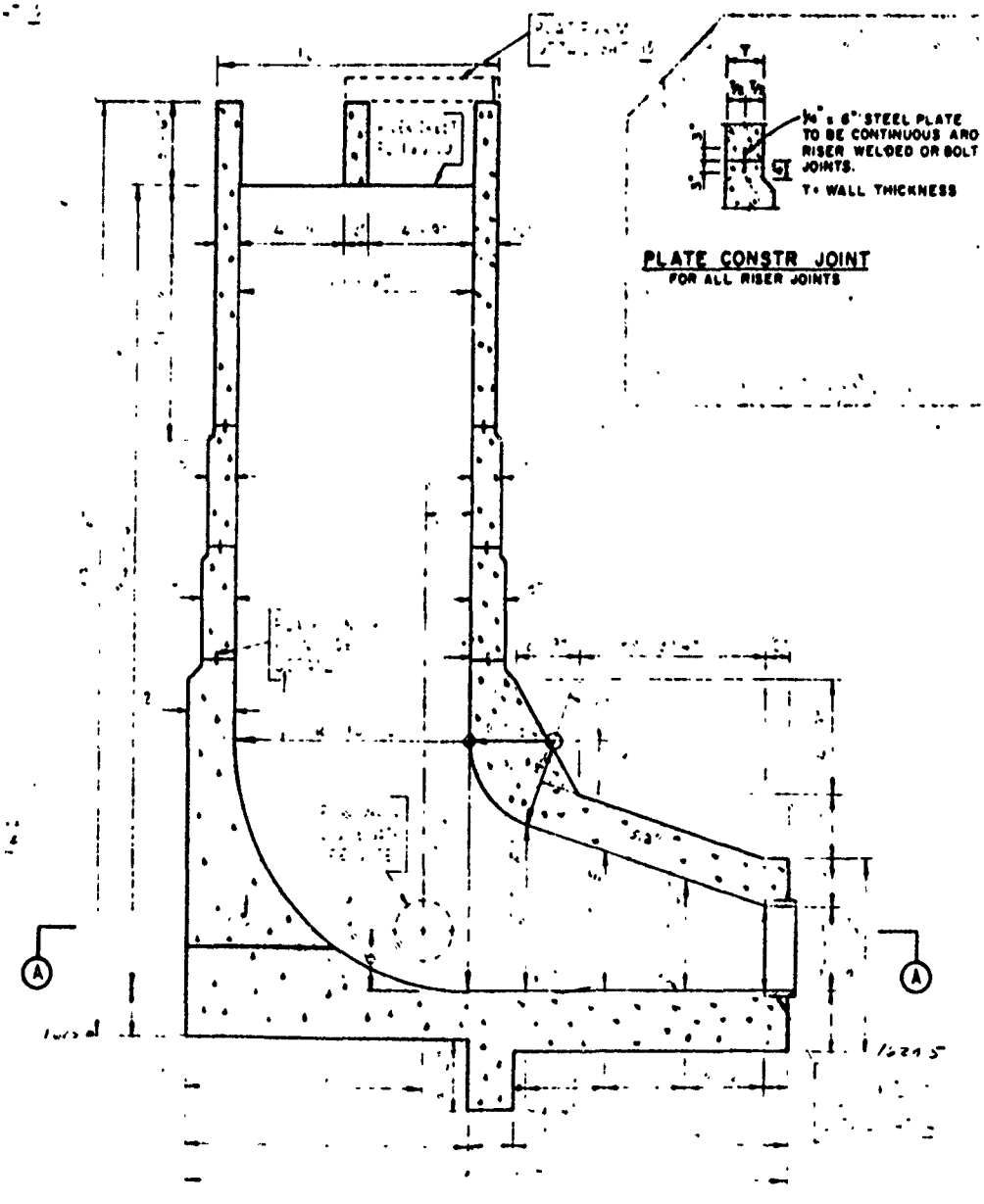
REVISIONS

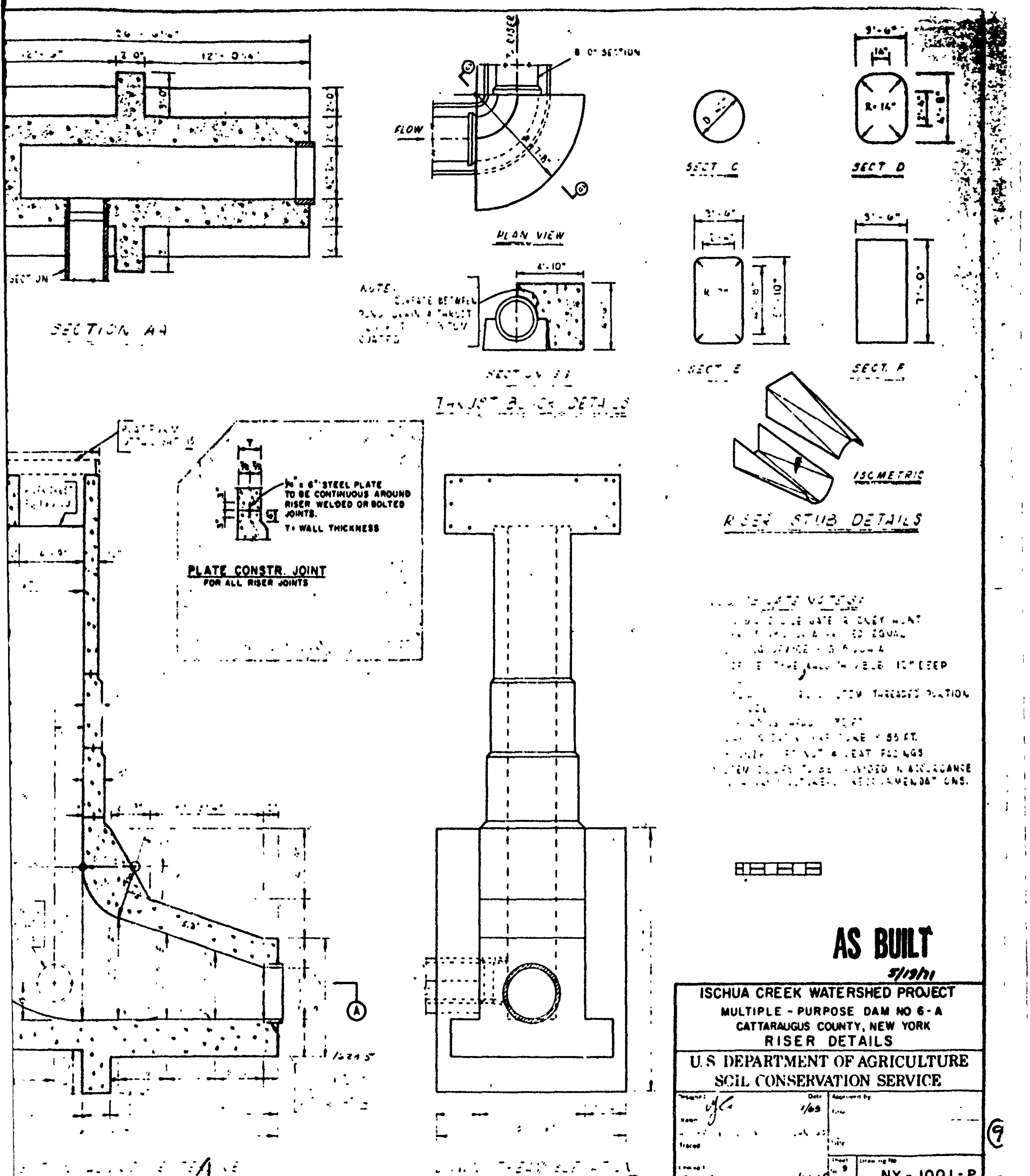




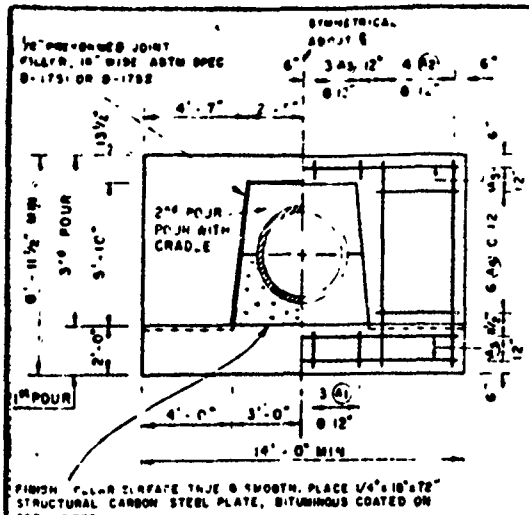
SECTION A-A

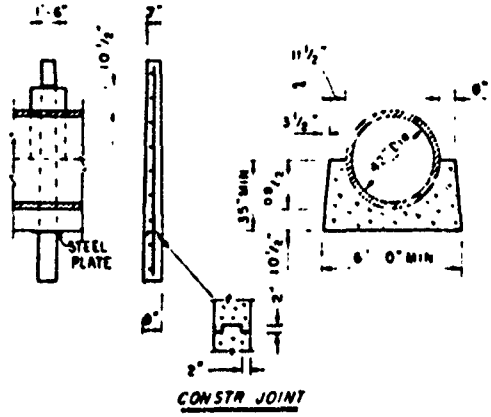






PLAN VIEW
FLOW
SECT C
SECT D
R=14"
SECT E
SECT F
SECTION AA
SECTION BB
THRUST BLOCK DETAILS
ISOMETRIC
RISER STUB DETAILS
¼" x 6" STEEL PLATE TO BE CONTINUOUS AROUND RISER WELDED OR BOLTED JOINTS.
T= WALL THICKNESS
PLATE CONSTR. JOINT
FOR ALL RISER JOINTS
AS BUILT
5/19/71
ISCHUA CREEK WATERSHED PROJECT
MULTIPLE - PURPOSE DAM NO 6 - A
CATTARAUGUS COUNTY, NEW YORK
RISER DETAILS
U.S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
1/69
NY - 1001 - P



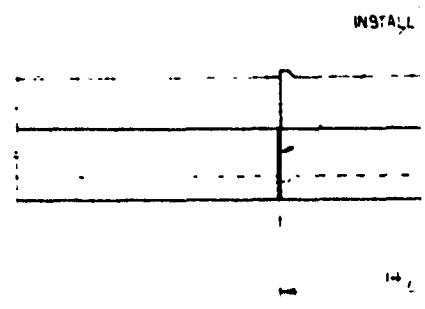


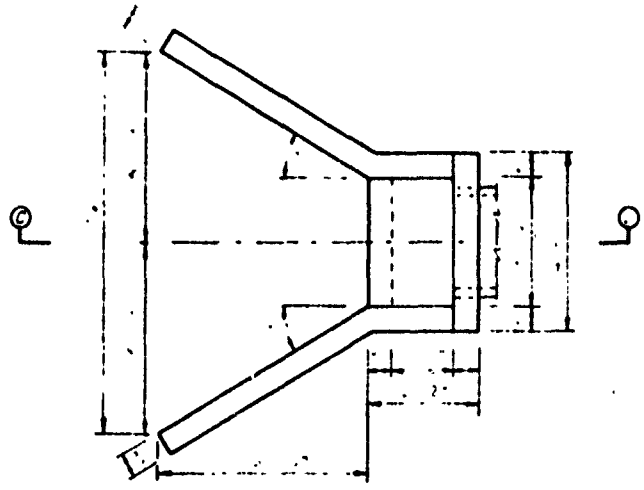
CONSTR JOINT

FINISH COLLAR SURFACE TRUE & SMOOTH. PLACE ¼"x18"x72" STRUCTURAL CARBON STEEL PLATE, BITUMINOUS COATED ON BOTH SIDES.

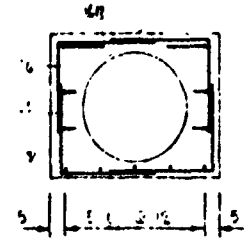
REINFORCED CONCRETE ANTI-SEEP COLLAR DETAILS

0 1 2 3 4 5 6 FEET
SCALE

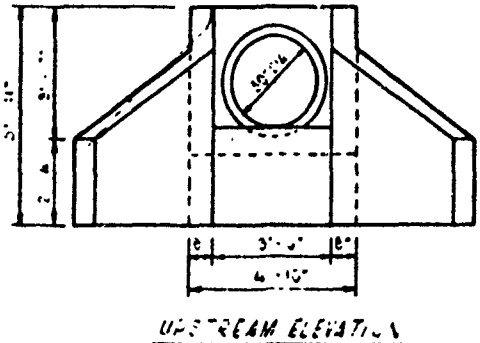




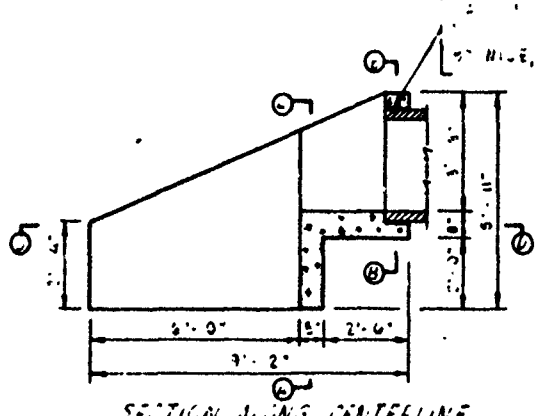
PLAN



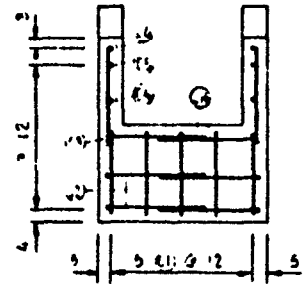
SECTION BB



UPSTREAM ELEVATION

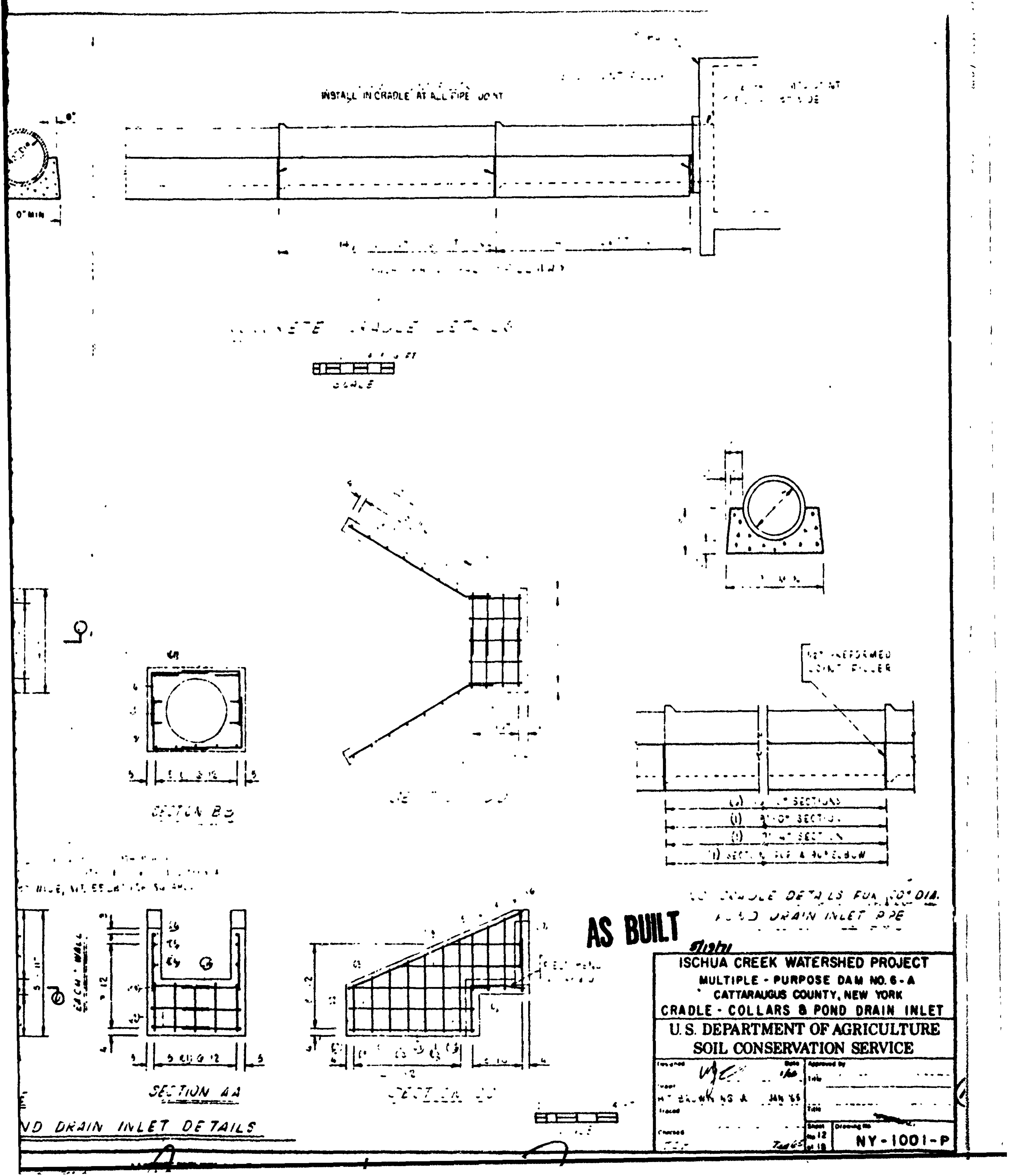


SECTION ALONG CENTERLINE



SECTION AA

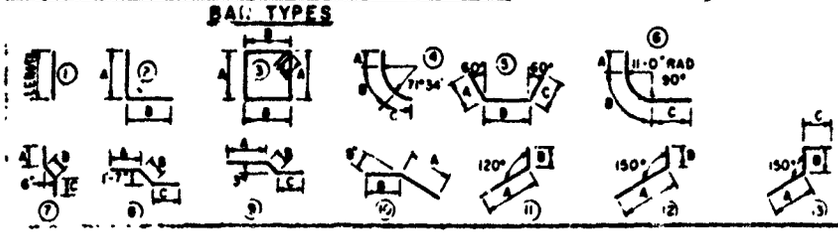
POND DRAIN INLET DETAILS


INSTALL IN CRADLE AT ALL PIPE JOINT
SECTION AA
ND DRAIN INLET DETAILS
AS BUILT
ISCHUA CREEK WATERSHED PROJECT
MULTIPLE - PURPOSE DAM NO. 6 - A
CATTARAUGUS COUNTY, NEW YORK
CRADLE - COLLARS & POND DRAIN INLET
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NY-1001-P

STEEL SCHEDULE

MARK	LOCATION	QUAN	SIZE	LENGTH	TYPE	A	B	C	TOTAL FT
1	BASE	36	5	13-2	2	4-7	1-7	0-5	474.00
2		6	8	15-0	2	5-5	7-9		288.00
3		10	5	11-8	1	-			180.00
4		16	6	12-0	2	6-6	1-6		192.00
5		106	5	4-9	1				505.50
6		16	8	11-0	1				176.00
7		99	5	11-0	1				1018.00
8		48	6	11-0	1				528.00
9		100	5	4-0	1				400.00
10		70	5	15-9	1				1107.50
11		156	5	11-9	1				1833.00
12		48	6	4-9	1				228.00
13		24	5	5-0	1				120.00
14		36	5	6-0	1				216.00
15		36	5	7-0	1				252.00
16		24	5	8-0	1				192.00
17		60	5	10-0	1				600.00
18		96	5	5-6	1				528.00
19		34	5	8-6	2	4-2	4-4		204.00
20		24	5	9-6	2	5-2	4-4		228.00
21		34	5	10-6	2	6-2	4-4		252.00
22		8	5	11-4	2	7-0	4-4		90.67
23		8	5	13-4	2	9-0	4-4		104.67
24		8	5	14-10	2	10-6	4-4		118.67
25		18	5	17-6	4	4-11	4-4	3-5	225.00
26		30	5	10-1	5	1-11	5-7	1-1	302.50
27		14	5	25-6	6	4-11	11-0	3-7	357.00
28		88	5	17-3	1	-			1518.00
29		126	5	17-3	7	14-8	0-9	2-8	2194.50
30		174	5	5-11	8	1-10	7-5	1-10	1041.55
31		16	7	7-0	1				112.00
32		32	7	10-0	1				320.00
33		40	7	11-0	1				440.00
34		30	6	11-6	1				330.00
35		40	5	17-0	2	12-5	4-9		680.00
36		48	8	8-11	2	4-2	4-9		428.00
37		48	5	9-9	1				475.00
38		24	6	6-11	2	2-5	4-6		166.00
39		40	6	13-5	1				445.00
40		12	5	4-3	7	1-11	0-9	1-9	51.00
41		148	6	11-6	1				1702.00
42		36	7	11-6	1				414.00
43		6	6	4-6	1				77.00
44		76	6	6-9	9	4-1	0-6	2-5	706.67
45		16	6	12-0	1				192.00
46		32	6	6-9	2	2-7	4-6		496.00
47		40	6	4-6	1				180.00
48		76	6	6-7	9	4-6	0-6	1-11	590.33
49		40	4	10-3	1				410.00
50		80	6	6-2	2	2-5	3-9		493.33
51		50	5	10-3	1				820.00
52		60	5	13-9	1				825.00
53		70	5	11-6	1				630.00
54		64	5	6-6	1				198.00
55		94	5	10-9	1				538.00
56		104	6	5-10	2	2-4	3-6		606.67
57		46	5	10-2	2	6-10	3-4		406.67
58		44	5	13-0	1				516.00
59		24	5	4-0	1				96.00
60		96	5	5-6	1				536.00
61		12	5	5-0	1				96.00
C-1	[illegible]	2	4	4-6	-	2-0	2-6		12.00
C-2		4	4	9-5	11	6-7	2-9		31.67
C-3		2	4	2-0	11	0-6	1-6		16.00
C-4		2	4	7-1	13	3-7	2-10	0-6	14.17
C-5		2	4	4-5	13	1-0	2-10	0-6	9.50
C-6		2	4	11-5	13	7-2	3-0	1-6	22.95
C-7		1	4	2-2	1				4.33
C-8		2	4	2-6	1				5.00
C-9		2	4	2-10	1				5.66
C-10		2	4	5-3	1				10.50
C-11		2	4	3-7	1				7.17
C-12		2	4	4-0	1				8.00
C-13		2	4	4-4	1				8.67
C-14		2	4	5-3	2	2-5	2-10		10.50
C-15		2	4	5-9	-	2-5	2-10		11.33
C-16		2	4	6-0	-	2-5	2-10		12.00
C-17		4	4	7-1	-	2-5	2-10		28.33
A-1	[illegible] (14)	84	4	1-6	1				126.00
A-2		112	4	8-6	1				952.00
A-3		84	4	0-6	1				42.00
A-4		168	4	3-6	1				588.00
A-5		42	4	13-6	1				567.00

BAR TYPES



TOTAL QUANTITIES

STEEL

NO. 4 BARS 3064.7 LIN FT 2041.6 LBS
NO. 5 BARS 30,195.9 LIN. FT. 31,452.0 LBS.
NO. 6 BARS 6990.0 LIN. FT. 10653.9 LBS
NO. 7 BARS 2999.7 LIN. FT. 4905.0 LBS
NO. 8 BARS 7089.5 LIN. FT. 18917.8 LBS.

TOTAL: 67,789 LBS.

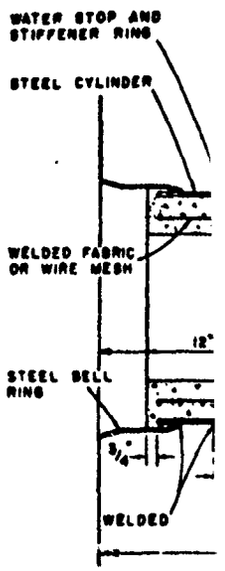
CONCRETE

CLASS "A" TYPE I 393.2 C.Y.
CLASS "A" TYPE II 42.5 C.Y.
CLASS "A" TYPE III 210.6 C.Y.

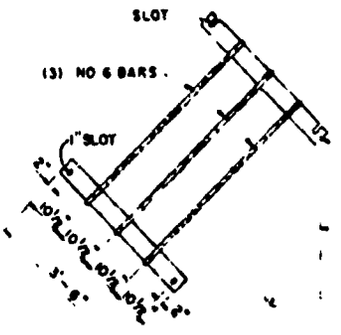
GENERAL NOTES:

1. ALL CONCRETE SHALL BE CLASS "A" AND OF THE TYPE NOTED
2. PORTLAND CEMENT TYPE IA OR TYPE I WITH AN AIR-ENTRAINING ADMIXTURE SHALL BE USED.
3. ALL REINFORCING STEEL TO BE LAPPED A MINIMUM OF 30 BAR DIAMETERS.
4. ALL REINFORCING STEEL PLACED IN CONCRETE POURED AGAINST THE GROUND SHALL HAVE A MINIMUM OF 3" CLEAR COVER WHERE FORMS ARE USED BARS SHALL HAVE A MINIMUM OF 2" CLEAR COVER.
5. ALL EXPOSED EDGES OF CONCRETE TO HAVE A 3/4" CHAMFER, UNLESS OTHERWISE NOTED.

NOTE:
STEEL SCHEDULE IS FOR 2 RISERS.



BELL RING WAI



POND DRAIN INLET

LOCATION	

CONCRETE

"A" TYPE I 393.2 C.Y.
"A" TYPE II 62.5 C.Y.
"A" TYPE III 210.4 C.Y.

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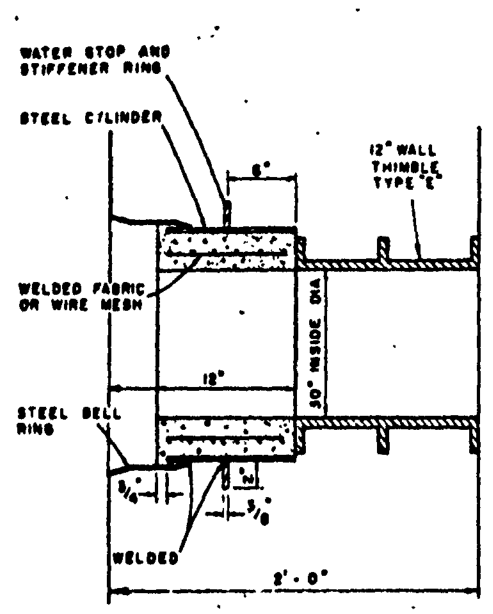
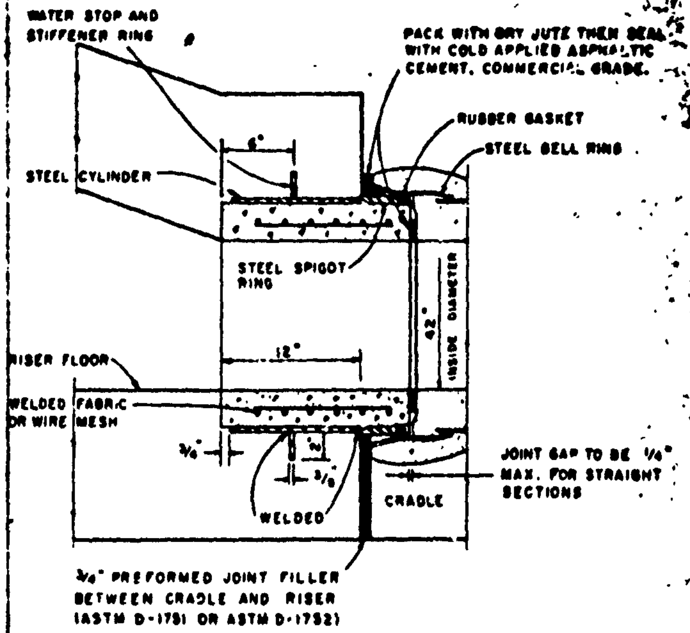
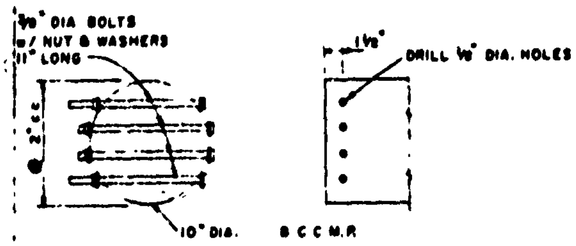


BELL RING WALL FITTING



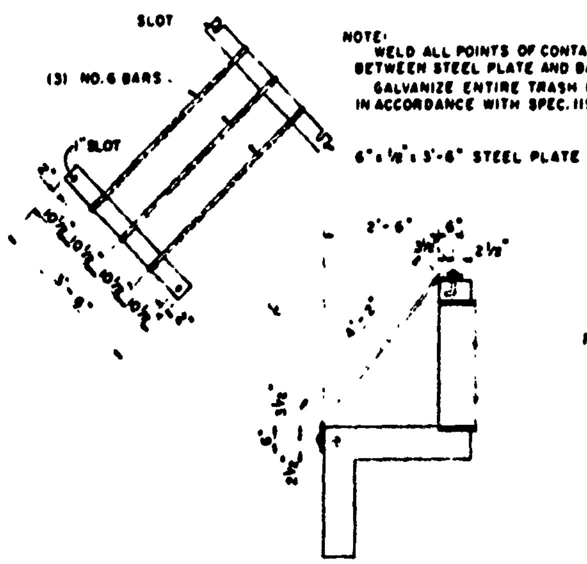
SPIGOT RING WALL FITTING



SMALL ANIMAL GUARD DETAILS

(4 REQUIRED)

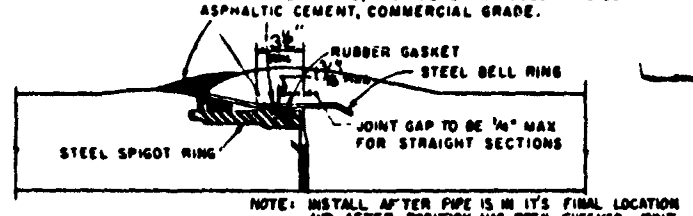
NOTE: WELD ALL POINTS OF CONTACT BETWEEN STEEL PLATE AND BARS. GALVANIZE ENTIRE TRASH RACK IN ACCORDANCE WITH SPEC. 119



POND DRAIN INLET TRASH RACK

NOTE: JOINT DIMENSIONS ADEQUATE FOR PIPES SUPPLIED IN SECTIONS EQUAL TO 20.0' OR LESS

SPECIAL JOINT: LOCK JOINT DRAWING NO B-2-946-42" OR APPROVED EQUAL



NOTE: INSTALL AFTER PIPE IS IN IT'S FINAL LOCATION AND AFTER POSITION HAS BEEN CHECKED JOINT COMPOUND TO BE PLACED IN LOWER HALF OF PIPE ONLY.

DETAIL OF REINFORCED CONCRETE WATER PIPE JOINT

AS BUILT

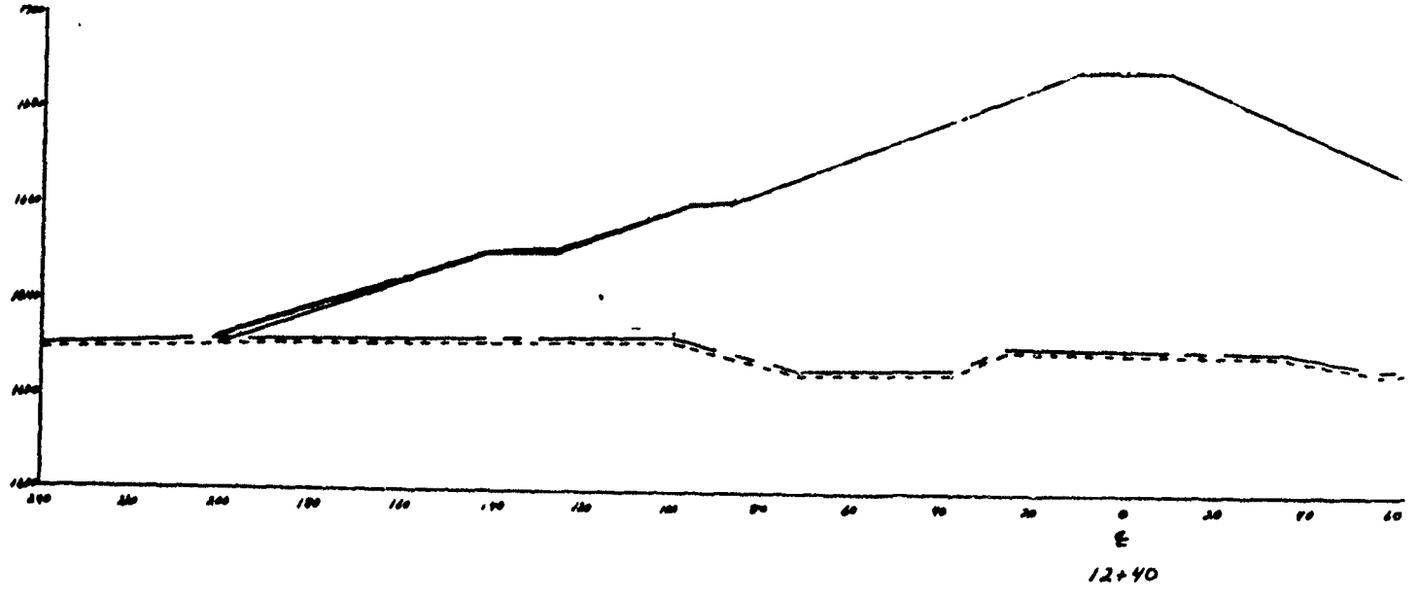
BILL OF MATERIAL

LOCATION	ITEM	SIZE	LENGTH	QUANTITY
[illegible]	[illegible]	[illegible]	[illegible]	3
	[illegible]	[illegible]	[illegible]	4

ISCHUA CREEK WATERSHED PROJECT
MULTIPLE - PURPOSE DAM NO 6-A
CATTARAUGUS COUNTY, NEW YORK
MISC DETAILS & STEEL SCHEDULE

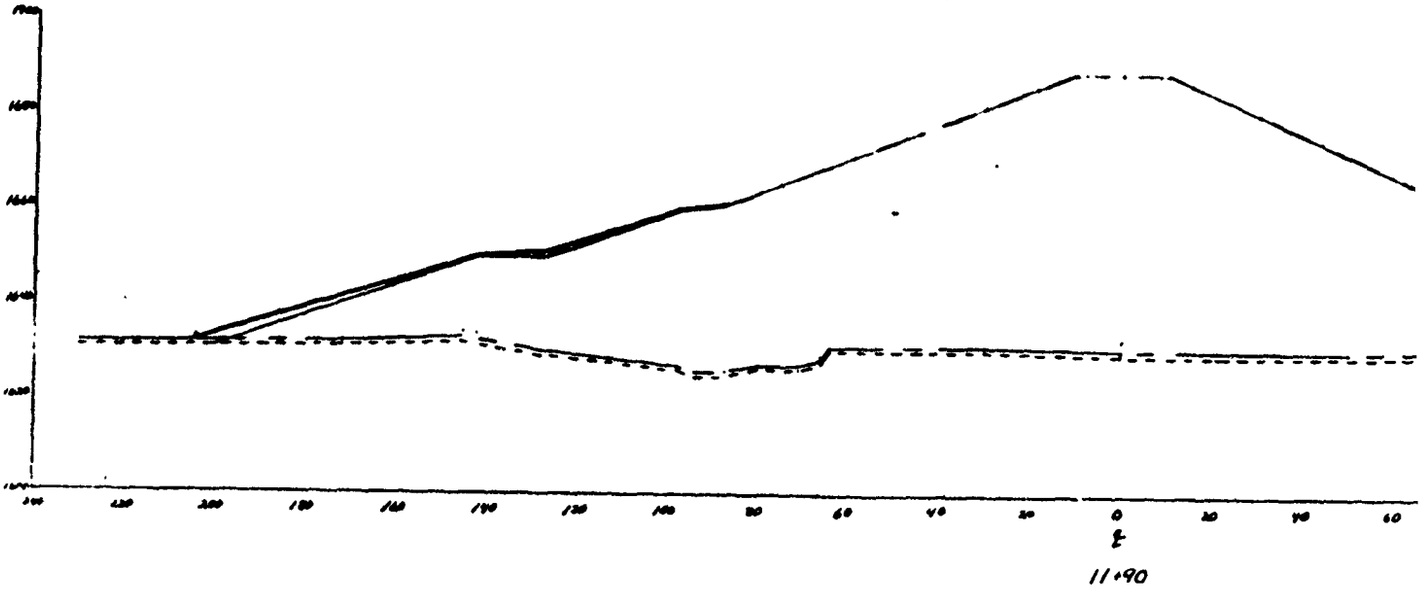
U.S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	Date	Approved by	
Drawn W.H. MORGAN	JAN.65	Title	
Traced		Title	
Checked	2/65	Sheet No 14 of 18	Drawing No NY-1001-P



℄

12+40



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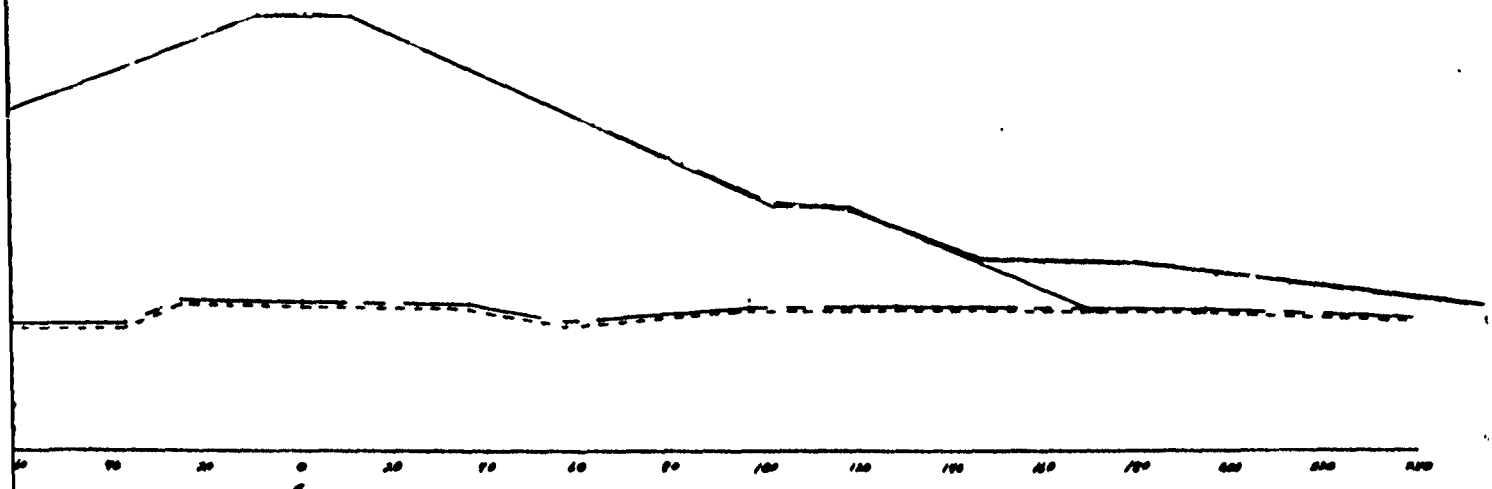
11+90

LEGEND



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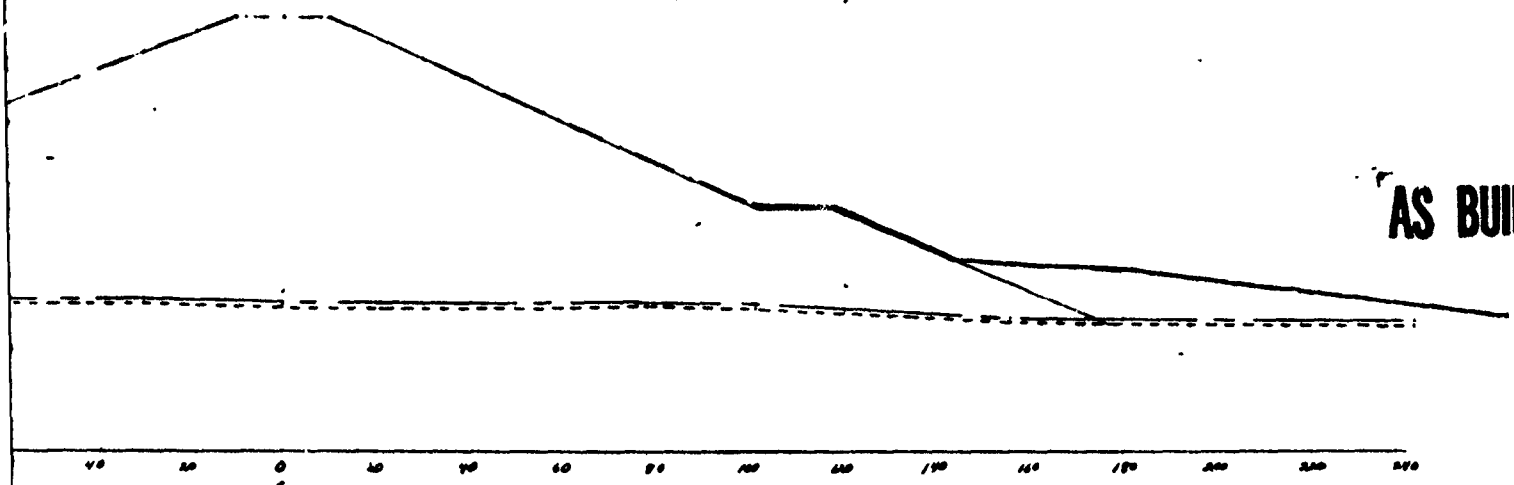
12+40



AS BUILT

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11+90

ISCHUA CREEK WATERSHED
SITE #6A
X-SECTIONS - DAM

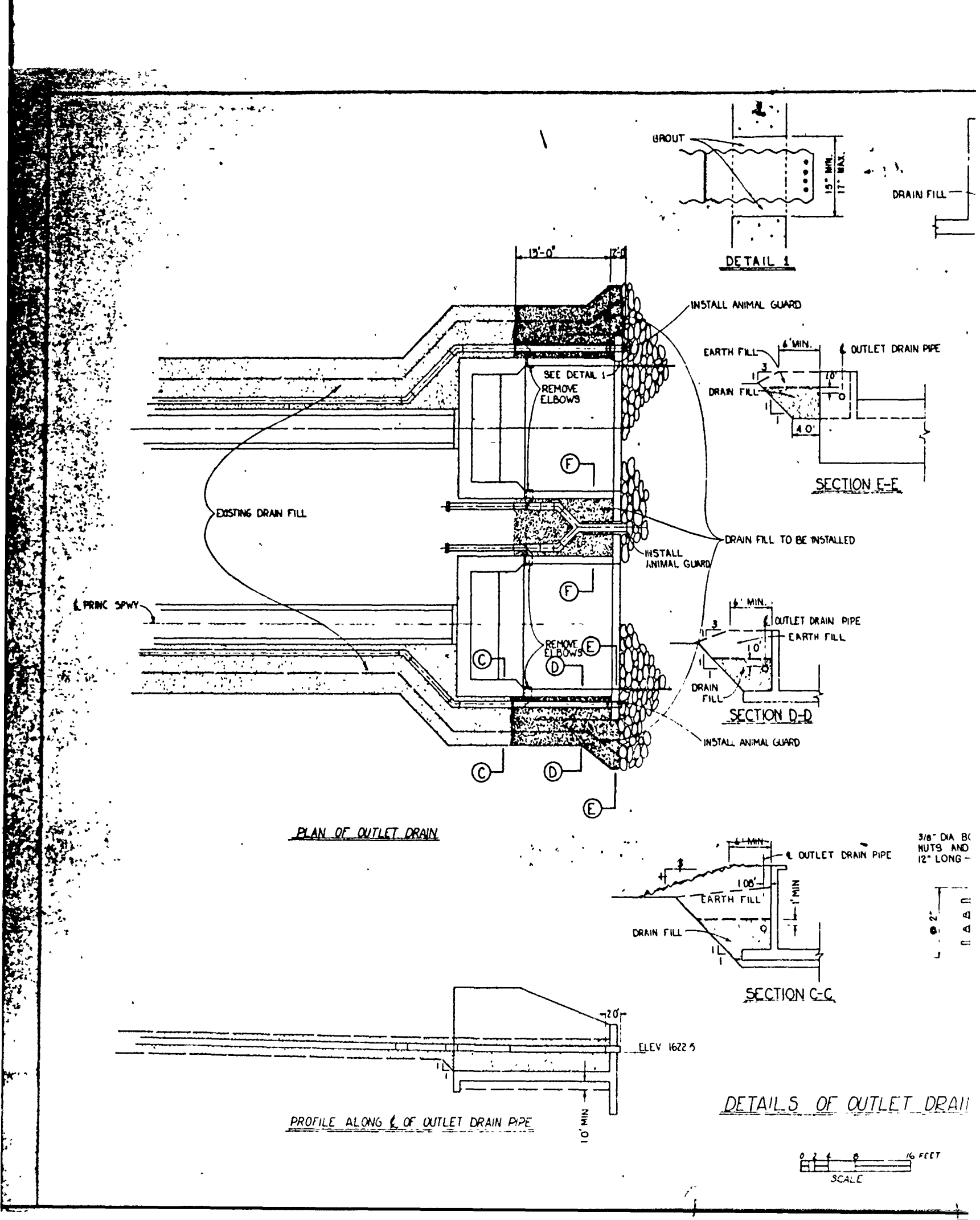
U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

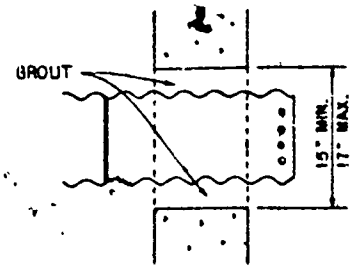
Drawn
E.S Barlow 1/70

LEGEND:
GROUND LINE
STRIP LINE
DESIGN
AS BUILT

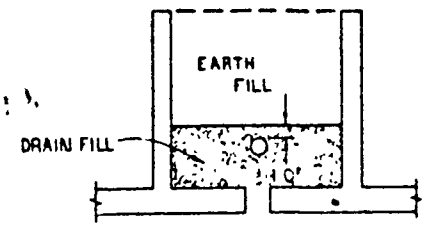
NOTES: GROUND LINE
FIELD BOOK #2
PAGES 10-11

(2)


GROUT
15" MIN.
17" MAX.
DRAIN FILL
DETAIL 1
13'-0"
7'-0"
INSTALL ANIMAL GUARD
SEE DETAIL 1
REMOVE ELBOWS
EXISTING DRAIN FILL
DRAIN FILL TO BE INSTALLED
INSTALL ANIMAL GUARD
℄ PRINC SPWY
REMOVE ELBOWS
INSTALL ANIMAL GUARD
PLAN OF OUTLET DRAIN
EARTH FILL
6' MIN.
℄ OUTLET DRAIN PIPE
DRAIN FILL
4.0'
SECTION E-E
℄ OUTLET DRAIN PIPE
EARTH FILL
DRAIN FILL
SECTION D-D
6' MIN.
℄ OUTLET DRAIN PIPE
1.08'
EARTH FILL
1' MIN
DRAIN FILL
SECTION C-C
3/8" DIA B
NUTS AND
12" LONG
20'
ELEV 1622.5
10' MIN
PROFILE ALONG ℄ OF OUTLET DRAIN PIPE
DETAILS OF OUTLET DRAI
0 2 4 8 16 FEET
SCALE



DETAIL 1



SECTION F-F

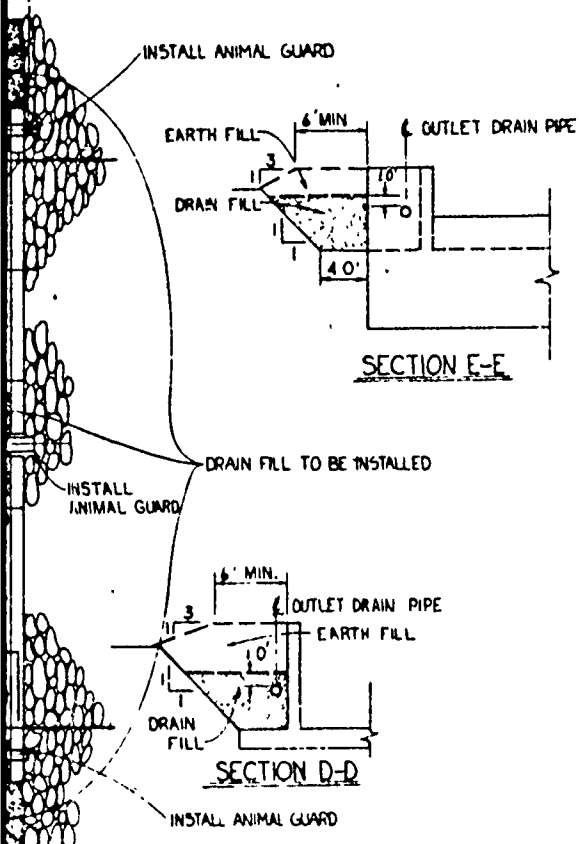
CONSTRUCTION DETAILS

1. REMOVE THE EXISTING PIPE AND EXTEND THE PIPES THROUGH THE IMPACT BASIN WINGWALLS AS SHOWN ON THIS SHEET.
2. THE HOLES IN THE SIDEWALLS WHERE THE ELBOWS ARE REMOVED AND THE SPACES AROUND THE NEW PIPE OUTLETS IN THE WINGWALLS SHALL BE PLUGGED WITH GROUT EXCEPT AS OTHERWISE APPROVED BY THE ENGINEER THE GROUTING MORTAR SHALL BE AS DESCRIBED IN CHAPTER VIII OF THE CONCRETE MANUAL, BUREAU OF RECLAMATION, U S. DEPARTMENT OF THE INTERIOR
3. INSTALL DRAIN FILL ALONG THE WALLS AS SHOWN ON THIS SHEET DRAIN FILL SHALL MEET THE GRADATION OF SCREENING #; OF THE STANDARD GRADATIONS FROM THE JANUARY 2 1962 NEW YORK PUBLIC WORKS SPECIFICATIONS IN ADDITION THE PERCENTAGE OF DRAIN FILL FINER THAN A #200 SIEVE SHALL NOT BE MORE THAN THREE (3) PERCENT
4. EARTH FILL AS SHOWN ON THE DRAWINGS SHALL BE PLACED IN HORIZONTAL LIFTS A MAXIMUM OF 8" THICK AND SHALL CONTAIN NO ROCKS LARGER THAN 3" COMPACTION SHALL BE A MINIMUM OF TWO (2) PASSES PER LIFT WITH A MANUALLY DIRECTED POWER TAMPER OR PLATE VIBRATOR WITH THE SOIL THROUGHLY WET BUT NOT SO WET AS TO CAUSE ADHERENCE OF THE SOIL TO THE EQUIPMENT, NOR TO CAUSE BOGGING DOWN OF THE EQUIPMENT.
5. DISTURBED AREAS SHALL BE SEEDED AND MULCHED UPON COMPLETION OF BACKFILLING

SEED (LAWN MIXTURE-30% CROWN VETCH)——½# PER 100 SQ.FT
MULCH (STRAW)——50# PER 100 SQ FT.
FERTILIZER (10-10-10)——3# PER 100 SQ FT

QUANTITY SUMMARY

100 CU.YDS EXCAVATION
90 CU YDS DRAIN FILL
140 CU YDS EARTH FILL
30 FT.10"NON-PERF. BCCMP
2 12"TO 10"BCCMP REDUCERS 6' LONG
1 12"BCCMP WYE 2' X 2' X 7' LONG

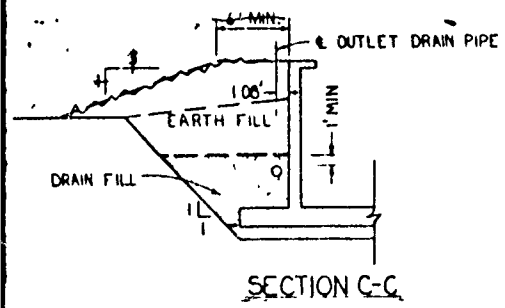


SECTION E-E

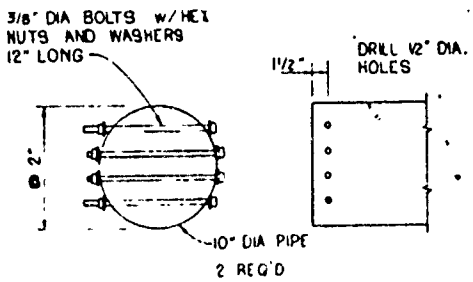
SECTION D-D

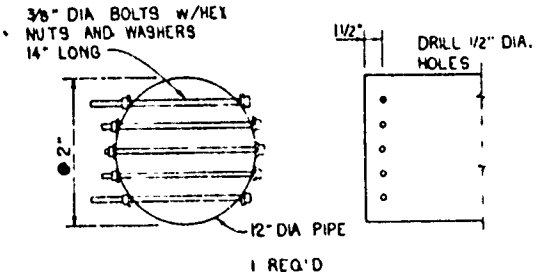
INSTALL ANIMAL GUARD

AS BUILT
5/31/74



SECTION C-C





SMALL ANIMAL GUARD DETAILS

20'
ELEV 1622.5

DETAILS OF OUTLET DRAIN

0 2 4 8 16 FEET
SCALE

ISCHUA CREEK WATERSHED PROJECT
MULTIPLE PURPOSE DAM NO 6-A
CATTARAUGUS COUNTY, NEW YORK
MODIFIED DRAIN OUTLETS
U. S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

LORING C IBBITSON 8/72
R G YOUNG 8/72

NY-1001-P